Technical Support Document:

Chapter 36
Final 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). Our Notice of Availability (NOA)[1] and our Technical Support Document[2] (TSD) for our intended designations for the round of designations we are required to complete by December 31, 2017, provided background on the relevant CAA definitions and the history of the designations for this NAAQS. Chapter 1 of this TSD for the final designations explains the definitions we are applying in the final designations. The TSD for the intended Round 3 area designations also described Puerto Rico's recommended designations, assessed the available relevant monitoring, modeling, and any other information, and provided our intended designations.

This TSD for the final Round 3 area designations for Puerto Rico addresses any change in Puerto Rico's recommended designations since we communicated our intended designations for areas in Puerto Rico. It also provides our assessment of additional relevant information that were submitted too close to the signature of the NOA to have been considered in our intended designations, or that have been submitted by Puerto Rico or other parties since the publication of the NOA. This TSD does not repeat information contained in the TSD for our intended designations except as needed to explain our assessment of the newer information and to make clear the final action we are taking and its basis, but that information is incorporated as part of our final designations. If our assessment of the information already considered in our TSD for our intended designations has changed based on new information and we are finalizing a designation based on such change in our assessment, this TSD also explains that change. For areas of Puerto Rico not explicitly addressed in this chapter, we are finalizing the designations described in our 120-day letters and the TSD for the intended Round 3 area designations. All the final designations are listed in Table 1 below.

EPA received new relevant information from the Puerto Rico's Environmental Quality Board (PREQB) that is addressed in this TSD chapter on October 23, 2017, and November 1, 2017.

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[1] EPA Responses to Certain State Designation Recommendations for the 2010 Sulfur Dioxide Primary National Ambient Air Quality Standard: Notification of Availability and Public Comment Period, September 5, 2017 (82 FR 41903)

[2] Technical Support Document: Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard, August 2017. https://www.epa.gov/sulfur-dioxide-designations/initial-technical-support-documents-area-designations-round-3

The October letter provided new modeling results for the San Juan and Guayama-Salinas areas. The modeling for the San Juan area was performed using emissions from PREPA San Juan and PREPA Palo Seco in the same modeling run, as well as a larger receptor grid. The modeling for the Guayama-Salinas area was also performed with a larger receptor grid.

In its November 1, 2017 letter to EPA, PREQB clarified that the March 2017 modeling protocol previously provided to EPA was used for the new modeling runs for the San Juan and Palo Seco areas (with the exception of the extended grid, and the modeling of PREPA San Juan and PREPA Palo Seco combined emissions). PREQB also provided modeling input files for the two new modeling runs when they submitted their letter on November 1.

EPA has reassessed our air quality modeling analysis for the San Juan and Guayama-Salinas areas. As we previously indicated in our earlier TSD for our intended designations, there was uncertainty regarding whether violations would occur beyond the previous receptor grid used by Puerto Rico. EPA's conclusion was based on the lack of information regarding the cumulative impact of PREPA San Juan and PREPA Palo Seco emissions, and the relatively small modeling domains used. Based on that uncertainty, EPA had intended to designate portions of the San Juan and Guayama-Salinas areas as unclassifiable. The updated modeling information provided by PREQB specifically addresses our concerns.

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

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

Area	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Designation	EPA's Final Area Definition	EPA's Final Designation[3]
San Juan Area	Within the Cataño Municipality: Palmas and Barrio Pueblo Wards	Nonattainment	Nonattainment	Within the Cataño Municipality: Palmas and Barrio Pueblo Wards	Nonattainment
	Within the Toa Baja Municipality: Palo Seco Ward and Sabana Seca Ward (partial)[4]	Nonattainment	Within the Tao Baja Municipality: Nonattainment for the Palo Seco and Sabana Seca Wards	Within the Tao Baja Municipality: Palo Seco and Sabana Seca Wards	Nonattainment
			Unclassifiable for the remaining wards in the Tao Baja Municipality[5]	Remaining wards in the Toa Baja Municipality	Attainment/ Unclassifiable

[3] Refer to Chapter 1 of Technical Support Document: Final Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for definitions of the designation categories and the terminology change from Unclassifiable/Attainment to Attainment/Unclassifiable.

[4] 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

[5] The remaining Wards in the Tao Baja Municipality that EPA intended to be designated as unclassifiable included: Toa Baja Pueblo, Media Luna, and Candelaria

Area	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Designation	EPA's Final Area Definition	EPA's Final Designation[3]
	Within the San Juan Municipality: San Juan Antiguo, Santurce, Hato Rey Norte, Hato Rey Sur, Hato Rey, El Cinco, Monacillo Urbano, and Gobernador Pinero[6] Wards	Nonattainment	Within the San Juan Municipality: Nonattainment for San Juan Antiguo, Santurce, Hato Rey Norte, and Gobernador Pinero	Within the San Juan Municipality: San Juan Antiguo, Santurce, Hato Rey Norte, and Gobernador Pinero	Nonattainment
			Unclassifiable for the remaining wards in the San Juan Municipality[7]	Remaining wards in the San Juan Municipality	Attainment/ Unclassifiable
	Within the Guaynabo Municipality: Pueblo Viejo and Frailes Wards	Nonattainment	Nonattainment for Pueblo Viejo Ward in the Guaynabo Municipality	Within the Guaynabo Municipality: Pueblo Viejo Ward	Nonattainment
			Unclassifiable for the remaining wards in the Guaynabo Municipality[8]	Remaining wards in the Guaynabo Municipality	Attainment/ Unclassifiable

[6] 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.

[7] The remaining wards in the San Juan Municipality that EPA intended to be designated as unclassifiable included: Hato Rey (Central), Hato Rey Sur, Oriente, Sabana Llana Norte, Sabana Llana Sur, Rio Piedras, Universidad, El Cinco, Monacillo Urbano, Monacillo, Cupey, Caimito, Tortugo, and Quebrada Arenas.

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

Area	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Designation	EPA's Final Area Definition	EPA's Final Designation[3]
	Within the Bayamón Municipality: Juan Sánchez Ward	Nonattainment	Within the Bayamón Municipality: Nonattainment for Juan Sánchez Ward	Within the Bayamón Municipality: Juan Sánchez Ward	Nonattainment
			Unclassifiable for the remaining wards in the Bayamón Municipality[9]	Remaining wards in the Bayamón Municipality	Attainment/ Unclassifiable
			Unclassifiable for the Dorado Municipality	Dorado Municipality	Attainment/ Unclassifiable
			Unclassifiable for the Toa Alta Municipality	Toa Alta Municipality	Attainment/ Unclassifiable
			Within the Carolina Municipality: Unclassifiable for the Cangrejo Arriba and Sabana Abajo Wards	Within the Carolina Municipality: Cangrejo Arriba and Sabana Abajo Wards	Attainment/ Unclassifiable
Guayama-Salinas Area	Within the Guayama Municipality: Jobos, and Pozo Hondo Wards	Nonattainment	Unclassifiable for the Guayama Municipality	Guayama Municipality	Attainment/ Unclassifiable

[9] The remaining wards in the Bayamón Municipality that EPA intended to be designated as unclassifiable included: Buena Vista, Cerro Gordo, Dajaos, Guaraguao Abajo, Guaraguao Arriba, Hato Tejas, Minillas, Nuevo, Pájaros, Barrio Pueblo, and Santa Olaya.

Area	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Designation	EPA's Final Area Definition	EPA's Final Designation[3]
	Within the Salinas Municipality: Aguirre Ward and Lapa Ward (partial)[10]	Nonattainment	Nonattainment for the Aguirre and Lapa Wards in the Salinas Municipality	Within the Salinas Municipality: Aguirre Ward and Lapa Ward	Nonattainment
			Unclassifiable in the remaining wards in the Salinas Municipality[11]	Remaining wards in the Salinas Municipality	Attainment/ Unclassifiable
			Unclassifiable for the Santa Isabel, Coamo, Aibonito, and Cayey Municipalities	Santa Isabel, Coamo, Aibonito, and Cayey Municipalities	Attainment/ Unclassifiable
Guayanilla Area	Guayanilla and Peñuelas Municipalities	Unclassifiable/ Attainment	Unclassifiable/ Attainment	Guayanilla and Peñuelas Municipalities	Attainment/ Unclassifiable
Rest of Territory*	Not specified	Unclassifiable/ Attainment	Unclassifiable/ Attainment	Rest of Territory	Attainment/ Unclassifiable

*These areas that we are designating as attainment/unclassifiable (those to which this row of this table is applicable) are identified more specifically in Section 6 of Chapter 36 (addressing Puerto Rico) of the TSD for our intended designations.

[10] The remaining wards in the Bayamón Municipality that EPA intended to be designated as unclassifiable included: Buena Vista, Cerro Gordo, Dajaos, Guaraguao Abajo, Guaraguao Arriba, Hato Tejas, Minillas, Nuevo, Pájaros, Barrio Pueblo, and Santa Olaya.

intended to be designated as unclassifiable included: Palmas, Quebrada Yeguas, Rio Jueyes, and Salinas Pueblo.

2. Technical Analysis of New Information for the San Juan Area

2.1. 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, Puerto Rico 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 to characterize air quality in the vicinity of any source in San Juan.

EPA received new relevant information from PREQB, including new modeling for the San Juan area. The new modeling followed the March 2017 protocol submitted by PREQB, except that the emissions from PREPA San Juan and PREPA Palo Seco were combined in the same modeling run and a larger receptor grid was used, in order to address the concerns pointed out in EPA's TSD for the 120-day letter for the area.

2.2. Summary of Information Reviewed in the TSD for the Intended Round 3 Area Designations

In the 120-day letter notification to the governor of Puerto Rico, and further explained in Chapter 36 of the TSD for the intended Round 3 area designations, EPA proposed designations of nonattainment and unclassifiable for different portions of the area based on all available information, including modeling information and all relevant monitoring information.

The following Table 2 identifies all the modeling assessments evaluated for the 120-day letters and discussed in the TSD for the intended Round 3 area designations. Additional details can be found in the TSD for the Intended Round 3 Area Designations, Chapter 36.

Table 2 – Modeling Assessments Evaluated in the TSD for the Intended Designation for the San Juan Area

Organization Submitting Assessment	Date of the Assessment	Identifier used in the TSD for the Intended Round 3 Area Designations, Chapter 36	Distinguishing or Otherwise Key Features
PREQB	March 3, 2017	PREPA San Juan	Met data 2007-2009
PREQB	March 3, 2017	PREPA Palo Seco	Met data 2007-2009

The EPA considered all available information for the San Juan area, including a revised modeling assessment provided by Puerto Rico on March 3, 2017. PREQB had updated the original modeling assessment submitted on December 19, 2016, after consultation with EPA to address issues associated with emissions, and averaging of modeled results to be consistent with

EPA guidance. PREQB also updated the model from version AERMOD 15181 to the most recent version, AERMOD 16216r. Based on the information at hand in August 2017, the EPA proposed to modify Puerto Rico's recommended boundaries for the San Juan nonattainment area. EPA also proposed to designate a portion of the San Juan area as unclassifiable due to uncertainty regarding the extent of air quality modeled violations beyond the receptor grid used by Puerto Rico.

2.3. Assessment of New Air Quality Monitoring Data for the San Juan Area

This factor considers the SO_2 air quality monitoring data in the San Juan area. Our TSD for the intended area designations considered available data through 2016 for the Cataño monitor (AQS ID 72-033-0004), and the Bayamón monitor (AQS ID 72-021-0006). As we indicated in the TSD for our intended designations, EPA believes that the data from the Cataño and Bayamón monitors did not provide information that could be used to support the designation recommendation for the area since they had not collected enough data for comparison to the NAAQS in recent years, and because the EPA does not have information indicating that they are located in the area of maximum impact.

We do not have certified data for any additional complete calendar years at any site, and we have no new monitoring information of any other type that warrants revising our prior analysis of available monitoring data.

2.4. Assessment of New Air Quality Modeling Analysis for the San Juan Area Addressing PREPA San Juan and PREPA Palo Seco

2.4.1. Introduction

This section 2.4 presents all the newly available air quality modeling information for the San Juan area 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 area will often be referred to as "the San Juan area" within this section 2.4.) This area contains the following SO_2 sources, principally the source(s) around which Puerto Rico was required by the DRR to characterize SO_2 air quality:

- 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.

Because we have available results of air quality modeling in which these sources are modeled together, the area around this group of sources is being addressed in this section with consideration given to the impacts of all these sources.

On October 23, 2017 and November 1, 2017 PREQB submitted new modeling analyzing air quality in the area surrounding the PREPA San Juan and PREPA Palo Seco facilities. This new assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. The two facilities listed above were analyzed in the same modeling run.

Based on the information at hand in August 2017, the EPA proposed to modify Puerto Rico's recommended boundaries for the San Juan nonattainment area. EPA also proposed to designate a portion of the San Juan area as unclassifiable due to uncertainty regarding the extent of air quality modeled violations beyond the receptor grid used by Puerto Rico.

Puerto Rico's updated analysis supports a different designation for the portion of the San Juan area that EPA had intended to designate as unclassifiable. Because PREQB's analysis shows that this portion meets the NAAQS and does not suggest that it contributes to a nearby area that does not meet the NAAQS, it supports a designation of attainment/unclassifiable for this portion of the San Juan area. The analysis, however, does not support a change to EPA's proposed nonattainment designation, nor to EPA's proposed nonattainment area boundaries, for the other portions of the San Juan area.

As seen in Figure 1 below, the PREPA San Juan and PREPA Palo Seco facilities are located in San Juan, Puerto Rico, near the 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).

Also included in Figure 1 are other nearby emitters of SO_2.[12] 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 or 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, which 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.

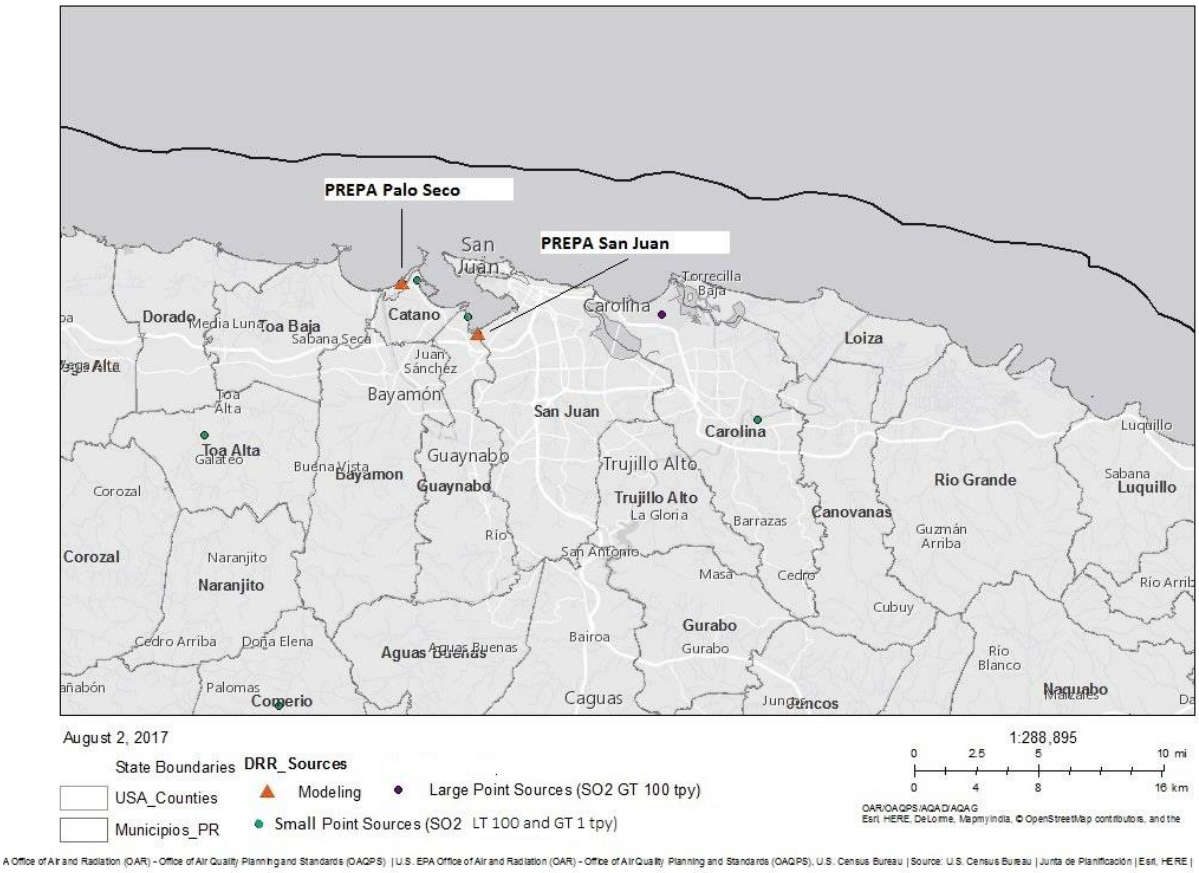
Pájaros, Barrio Pueblo, and Santa Olaya.

intended to be designated as unclassifiable included: Palmas, Quebrada Yeguas, Rio Jueyes, and Salinas Pueblo.

re are no additional SO_2 emitters above this emission level in the vicinity of the named source(s).

The EPA's final designation boundaries for the San Juan nonattainment and attainment/unclassifiable areas are not shown in Figure 1, but are shown in a in the section below that summarizes our final 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 Technical Assistance Document (TAD) and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance cited in Chapter 1 of this TSD, as appropriate.

For this area, the EPA received and considered one new modeling assessment, beyond those identified above in Table 2 that were reviewed in its TSD for its intended designations, submitted by Puerto Rico. To avoid confusion in referring to these assessments, the following table describes this assessment, indicating when it was received, providing an identifier for the assessment that is used in the discussion that follows, and identifying any distinguishing features of the modeling assessment.

Table 3 –New Modeling Assessment for the San Juan Area

Organization Submitting Assessment	Date of the Assessment	Identifier Used in this TSD	Distinguishing or Otherwise Key Features
PREQB	October 23, 2017 and November 1, 2017[a]	PREPA San Juan and PREPA Palo Seco	Met data 2007-2009

[a] The 10/23 submission was limited to modeling results. Modeling files and confirmation of protocol used were provided on 11/01

2.4.2. Differences Among and Relevance of the Modeling Assessments

The new modeling for the San Juan area submitted by PREQB has two significant differences compared to the 120-day modeling previously submitted by the Commonwealth. In the old modeling analysis, PREPA San Juan and PREPA Palo Seco were modeled separately; in the new analysis, both facilities were combined in the same modeling run due to their proximity to each other. Additionally, in the previous analysis, there were violating receptors at the edge of the grid. In the new analysis, PREQB extended the boundaries for the receptor grid until there were no violating receptors. While a limited number of receptors increase in the combined analysis, the overall maximum concentration is the same and occurs at the same receptor as the previous analysis. All further discussion of the state modeling reflects evaluation of the newer analysis. Most of the following subsections of Section 2.4 are similar to the TSD submitted for the 120-day modeling; except for Section 2.4.5 which discusses the receptor grid.

2.4.3. 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

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

2.4.4. Modeling Parameter: Rural or Urban Dispersion

For the purpose of performing the modeling for the area of analysis, PREQB 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.

2.4.5. 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 sources of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. 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.

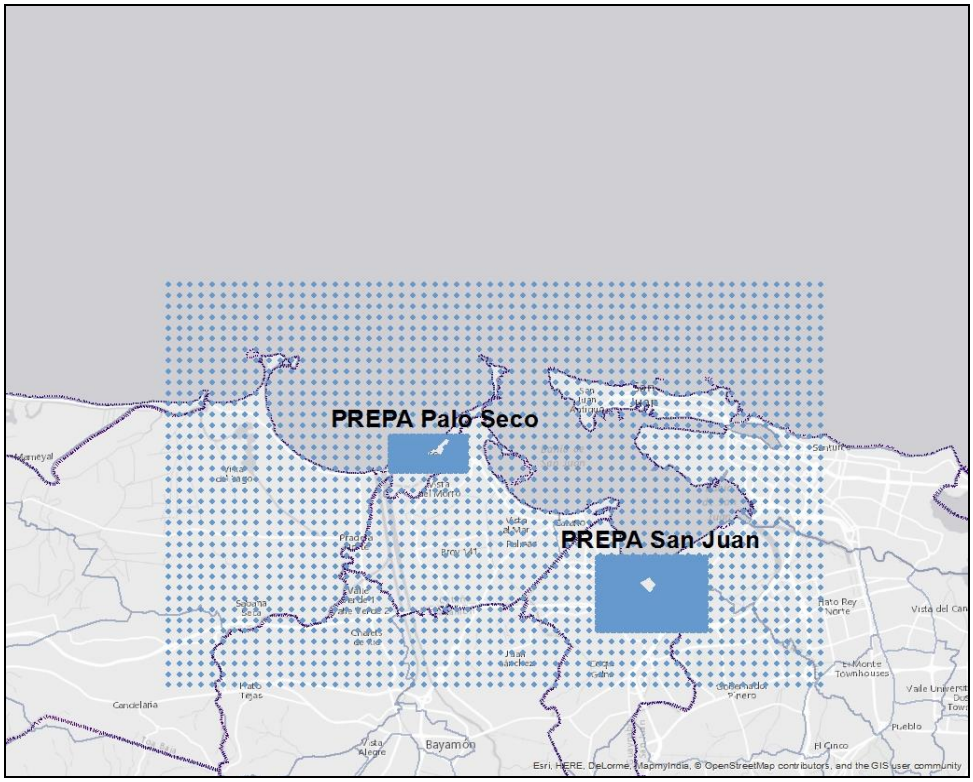
Regarding PREPA San Juan and PREPA Palo Seco's analyses, the grid receptor spacing for the area of analysis chosen by Puerto Rico is as follows: the first was a coarse receptor grid with a 250 meter (m) spacing to determine the distance out to which the facility could potentially cause or contribute 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 contained 5,112 receptors, and the network covered primarily an area to the west of PREPA San Juan 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 9.3 km in length and 15 km in width and captured all violating receptors.

Figure 2, 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 around each facility precluded public access.

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

2.4.6. 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

PREQB 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 sources. The concentrations further downwind and outside the wake area would be the same or possibly less with or without accounting for downwash. However, since the area already violated the NAAQS even without accounting for downwash, the area would be considered nonattainment regardless of the additional near-source contributions due to downwash. Therefore, EPA finds that not using downwash in the modeling of PREPA San Juan and PREPA Palo Seco did not affect the outcome in the area for purposes of this action. However, when developing an attainment plan to address the NAAQS violations, Puerto Rico will need to accurately account for downwash in order to successfully demonstrate that any remedial emissions controls and reductions at these sources will result in NAAQS attainment throughout the nonattainment area.

2.4.7. 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 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, PREQB 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 Territory'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 4. A description of how the Commonwealth obtained hourly emission rates is given below this table.

Table 4. 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 PREQB 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 PREQB 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 PREQB. EPA believes that utilizing fuel usage data is an acceptable method for estimating emissions in the absence of CEMs.

2.4.8. Modeling Parameter: Meteorology and Surface Characteristics

As noted in the Modeling TAD, the most recent 3 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 San Juan area, PREQB 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 the 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).

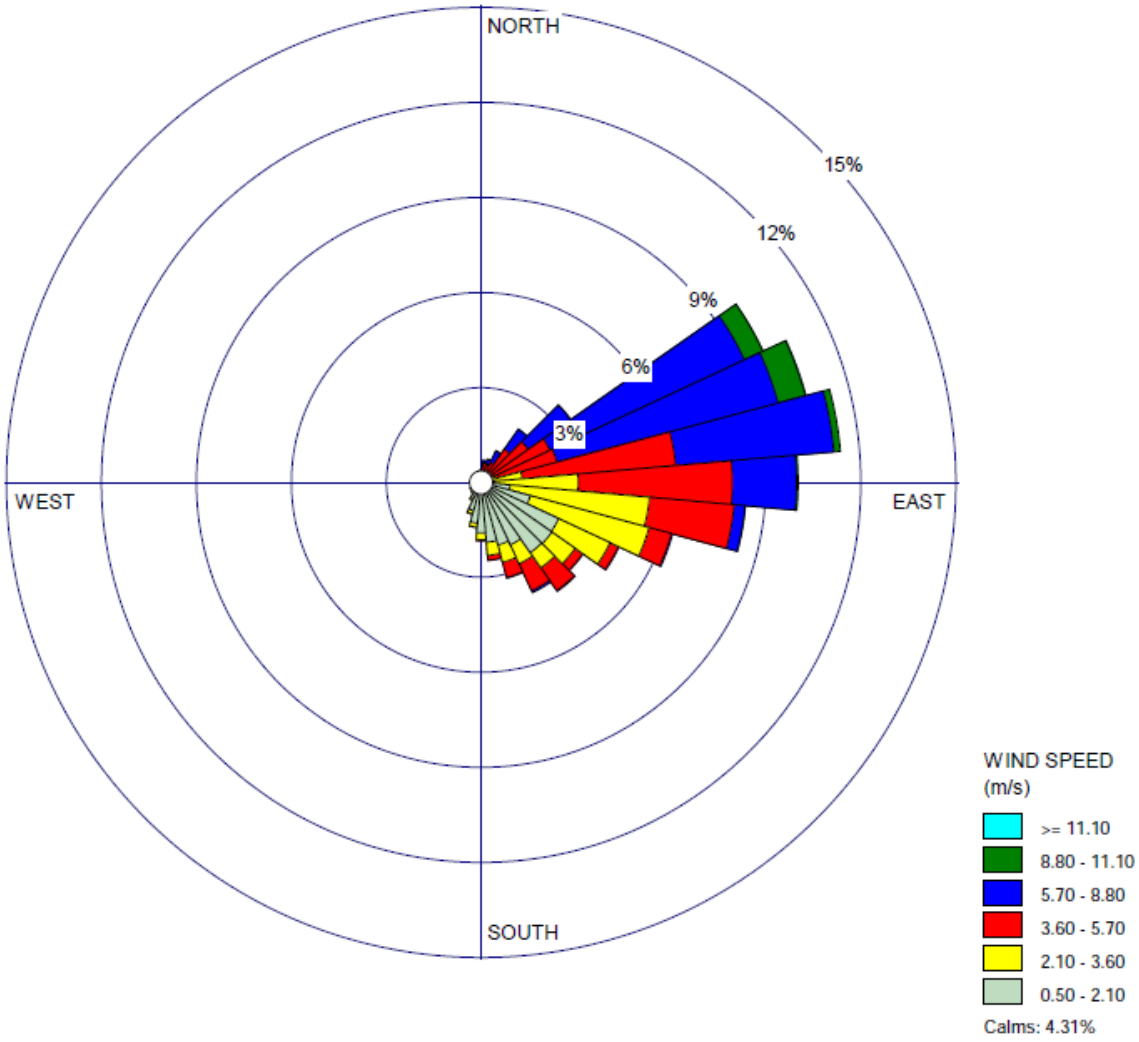
The land cover categories values were obtained by tables given in USEPA *AERSURFACE User Guide* (2008), together with fractions of the total area of interest. The area fractions of land cover classifications were calculated based on satellite maps, available aerial photographs, and observational visits 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 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, with strong easterly trade winds and even though Puerto Rico used older meteorological data, it is still representative of 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.

2.4.9. 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 to gently rolling. To account for any changes in terrain elevations, 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.

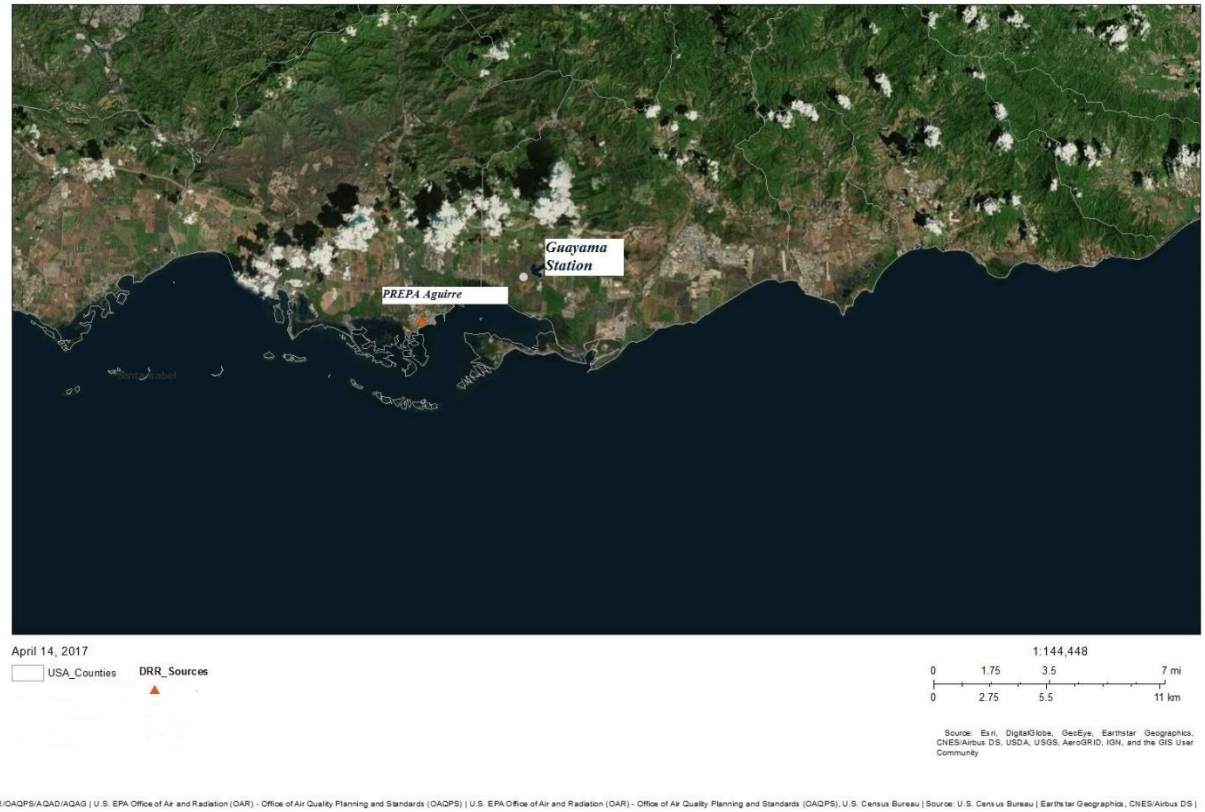
2.4.10. Modeling Parameter: Background Concentrations of SO_2

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 Bayamón (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. Sources impacting the Guayama monitor include the AES Cogeneration Plant in Jobos, Guayama, less than 5 km upwind of the monitor. Using a background monitor in such close proximity to a moderately sized point source resulted in using a relatively conservative background.

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 PREQB's approach for using the identified monitor for background concentration. Due to data completeness issues, EPA believes it would be more appropriate to use the 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 2008-2010 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



2.4.11. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the San Juan area of analysis are summarized below in Table 5.

Table 5. Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the San Juan Area

Input Parameter	Value
AERMOD Version	16216r (regulatory options)
Dispersion Characteristics	Urban
Modeled Sources	2
Modeled Stacks	12
Modeled Structures	0
Modeled Fencelines	2
Total receptors	5,112
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 6 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

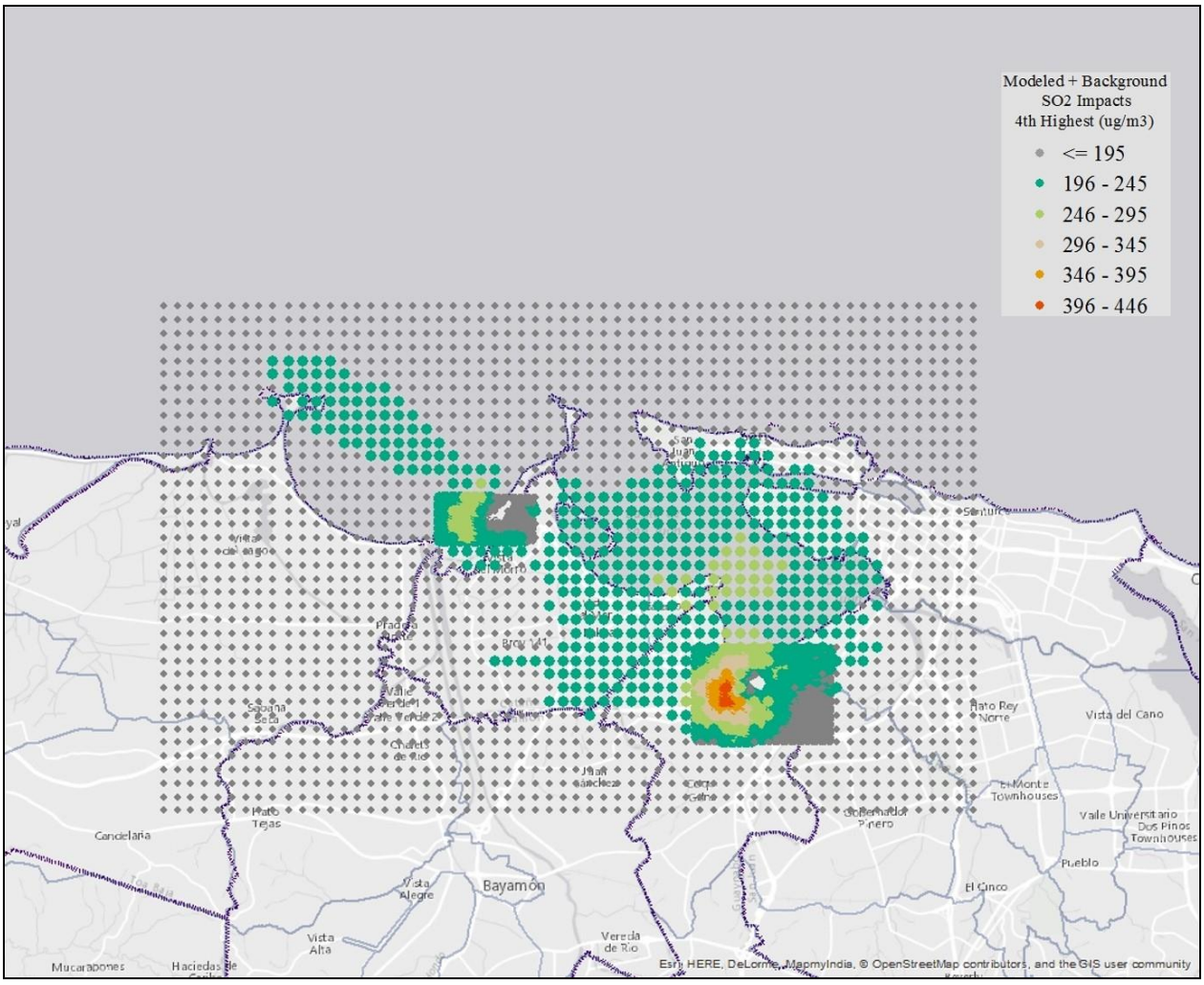
Table 6. Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentration Averaged Over Three Years for the Area of Analysis for the San Juan Area

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 reflecting 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 to 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 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 PREPA San Juan. The Commonwealth's receptor grid is also shown in Figure 6. While a limited number of receptors show an increase in the combined analysis, the overall maximum concentration is the same and occurs at the same receptor as shown by the previous analysis discussed in the TSD for the 120-day letter.

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



The updated 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 was modeled. The information is relevant to the selection of the boundaries of the area that will be designated. Puerto Rico's recommendation to EPA was based on the municipalities and wards that were within the boundary impact radius, which is the maximum radius of modeled results over the 1-hour SO_2 NAAQS, and is based on the outermost violating receptor.

In its earlier March 2017 modeling submission to EPA, where PREPA Palo San Juan and PREPA Palo Seco were modeled separately, PREQB provided figures showing the boundary impact radius for each facility. EPA notes that PREQB did not provide an updated boundary impact radius for the revised modeling (when emissions from PREPA San Juan and PREPA Palo Seco were included in the same modeling run). Figures 7 and 8 below show the maps with the previously identified portions of the San Juan area recommended by Puerto Rico for nonattainment based on the boundary impact radius for each facility.

Figure 7 shows a map of the portions (i.e., wards) of the San Juan, Guaynabo, Bayamon, and Cataño municipalities recommended by Puerto Rico for the boundary impact radius of PREPA San Juan. It should be noted that the radius provided reflects Puerto Rico's background concentration of 58 μg/m3, 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 boundary impact radius.

Figure 8 shows a map with the municipalities and wards recommended by Puerto Rico for the boundary impact radius of PREPA Palo Seco. These included the municipalities of Toa Baja and Cataño. In the Cataño municipality, Puerto Rico recommended the jurisdictional limit for Palmas ward and the Palo Seco ward jurisdictional limit in Toa Baja municipality. In the case of the Sabana Seca ward in Toa Baja, the Puerto Rico recommendation was 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.

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

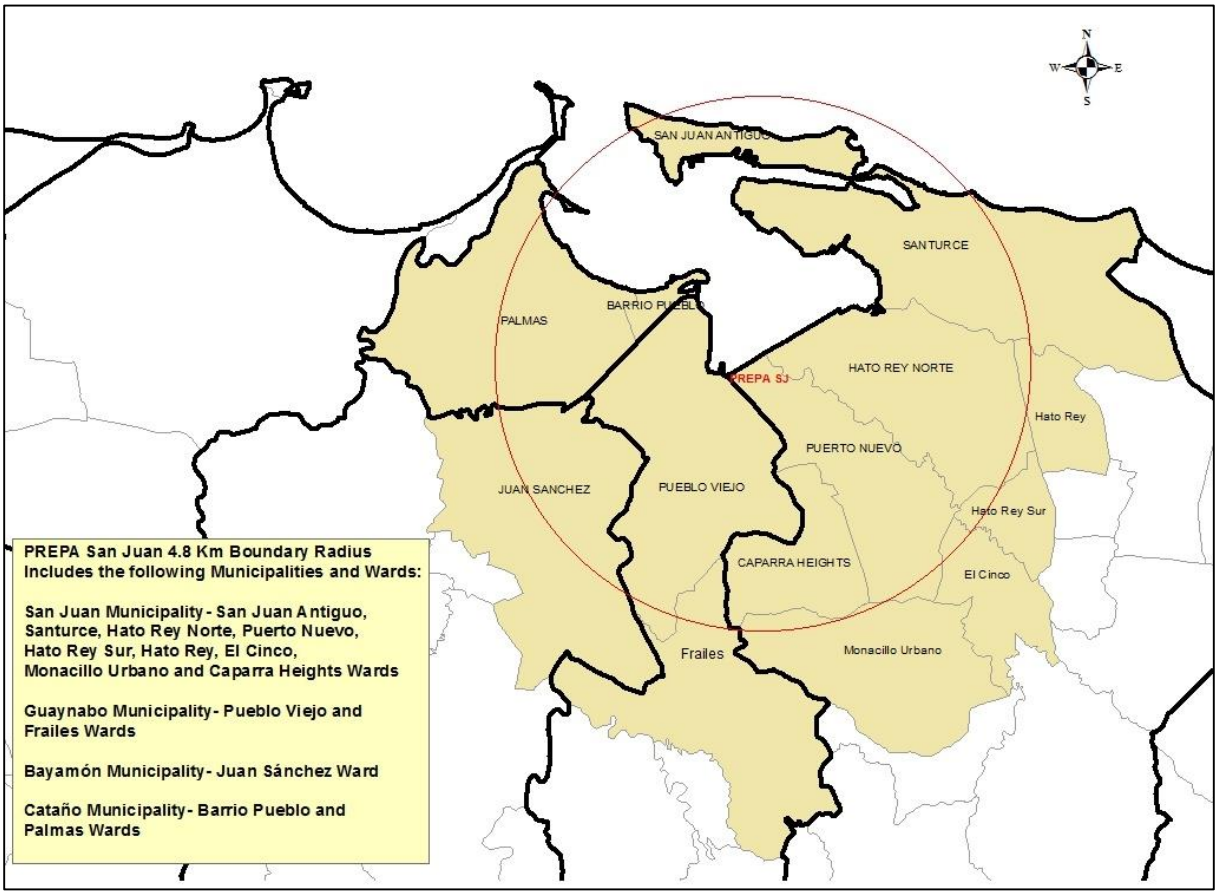
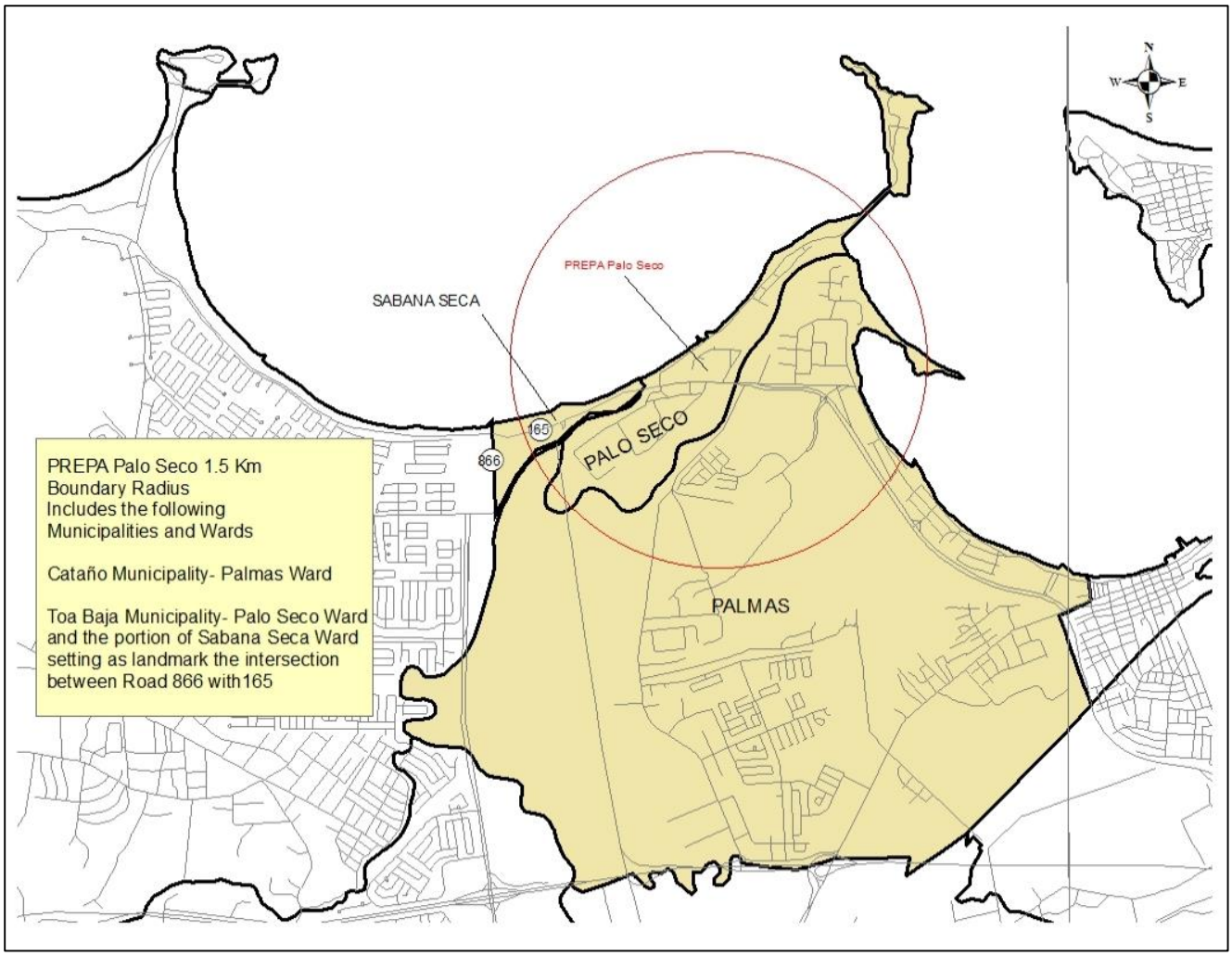


Figure 8: PREPA Palo Seco 1-Hour SO_2 Modeling Results Boundary Impact Radius, Years 2013-2015



2.4.12. The EPA's Assessment of the Modeling Information Provided by the Territory

Based on the information provided by Puerto Rico and summarized in Section 2.4, 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.

2.5. 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.

2.6. 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, Gobernador 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, 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 impacted area 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.

EPA believes the municipalities and wards provide clearly defined legal boundaries and align with existing administrative boundaries. EPA's assessment of how the boundaries fit with the modeled violating receptors is further discussed in Section 2.8 below.

2.7. Other Additional 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.

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

The modeling analysis for the San Juan Area addressing PREPA San Juan and PREPA Palo Seco provided by PREQB shows violating receptors in the Cataño, San Juan, Guaynabo, Toa Baja, and Bayamón municipalities.

Specifically, violating receptors were shown in 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, 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.

The predicted SO_2 impacts shown in Figure 6 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. Puerto Rico had recommended including these additional wards in the San Juan nonattainment area based on the boundary impact radius as determined from the previous modeling (from the earlier March 2017 modeling submission when PREPA San Juan and PREPA Palo Seco were modeled separately).

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. The airport is 12 km east of PREPA San Juan, and approximately 10 km from the nearest violating receptor. Any contributions to the impacts from the airport would be accounted for in the background.

EPA does not believe that the Luis Munoz Marin Airport contributes to the violating receptors in the San Juan area based on the location of the violating receptors, which are in close proximity to the much larger PREPA San Juan and PREPA Palo Seco facilities. As shown in figure 6, the distance of the furthest violating receptor on the eastern boundary of the receptor grid is approximately 2 km east of PREPA San Juan. Violating receptors extend approximately 3 km west of PREPA San Juan, and less than 1 km west of PREPA Palo Seco. SO_2 emissions from PREPA San Juan, and PREPA Palo Seco dwarf the emissions from the airport. In 2015 PREPA San Juan emitted over 6,000 tons of SO_2. PREPA Palo Seco emitted approximately 3,000 tons of SO_2.

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.

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 2008-2010 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 final 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 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).

As mentioned earlier in this TSD, in the previous modeling analysis submitted by PREQB, PREPA San Juan and PREPA Palo Seco were modeled separately, and there were violating receptors at the edge of the grid. Based on that uncertainty, EPA had intended to designate the remainder of the San Juan area as unclassifiable. In the new analysis, both facilities were combined in the same modeling run due to their proximity to each other, and PREQB extended the boundaries for the receptor grid until there were no violating receptors.

The revised modeling provided by PREQB removes the uncertainty regarding the remainder of the San Juan area. This area includes the remainder of the Toa Baja, Cataño, Bayamon, Guaynabo, and San Juan municipalities, as well as the Dorado and Toa Alta municipalities, and the northwestern portion of the Carolina municipality, (i.e., Cangrejo Arriba ward, and Sabana Abajo ward).

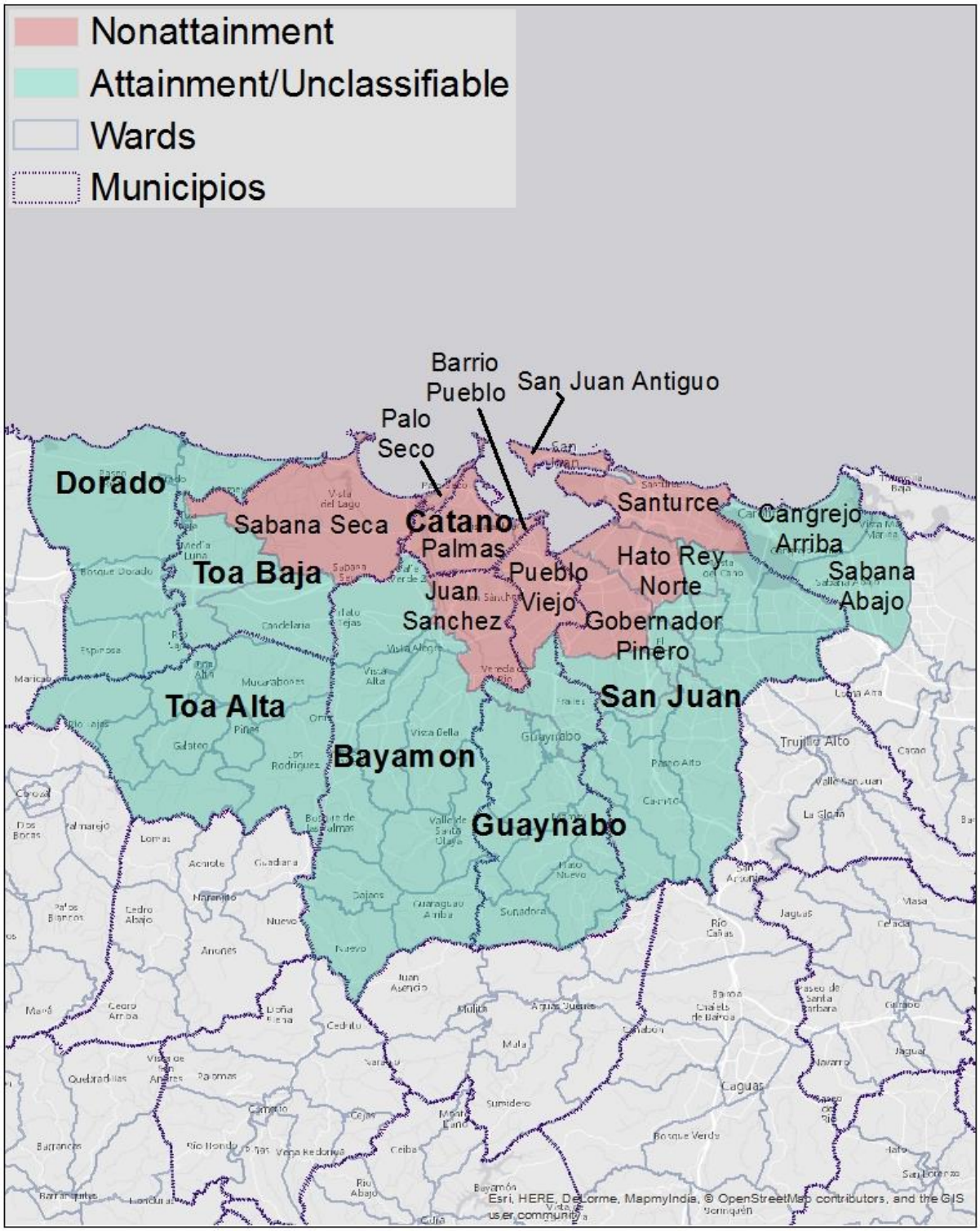
2.9. Summary of Our Final Designation for the San Juan Area

After careful evaluation of Puerto Rico's recommendation and supporting information, as well as all available relevant information, the EPA is finalizing the designation of 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, 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 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 is finalizing the designation of the remaining portions of the Toa Baja, San Juan, Guaynabo, and the Bayamón municipalities as attainment/unclassifiable. EPA is also finalizing the designation of the Cangrejo Arriba and Sabana Abajo Wards in the Carolina municipality along with the Dorado and Toa Alta Municipalities as attainment/unclassifiable. Figure 9 shows the boundary of these intended designated nonattainment and attainment/unclassifiable areas.

Figure 9: Boundary of the Final San Juan Area Nonattainment and Attainment/Unclassifiable Area



3. Technical Analysis of New Information for the Guayama-Salinas Area

3.1. Introduction

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

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 to characterize air quality in the vicinity of any source in Guayama-Salinas.

EPA received new relevant information from PREQB, including new modeling for the Guayama-Salinas area. The new modeling for the Guayama-Salinas area followed the March 2017 protocol submitted by PREQB, except that a larger receptor grid was used, in response to the concerns pointed out in EPA's review.

3.2. Summary of Information Reviewed in the TSD for the Intended Round 3 Area Designations

In the 120-day letter notification to the governor of Puerto Rico, and further explained in Chapter 36 of the TSD for the intended Round 3 area designations, EPA proposed designations of nonattainment and unclassifiable for different portions of the area based on all available information, including modeling information and all relevant monitoring information.

The following Table 7 identifies all the modeling assessments evaluated for the 120-day letters and discussed in the TSD for the intended Round 3 area designations. Additional details can be found in the TSD for the Intended Round 3 Area Designations, Chapter 36.

Table 7 – Modeling Assessments Evaluated in the TSD for the Intended Designation for the Guayama-Salinas Area

Organization Submitting Assessment	Date of the Assessment	Identifier used in the TSD for the Intended Round 3 Area Designations, Chapter 36	Distinguishing or Otherwise Key Features
PREQB	March 3, 2017	PREPA Aguirre	Met data 2001-2003

The EPA considered all available information for the Guayama-Salinas area, including a revised modeling assessment provided by Puerto Rico on March 3, 2017. PREQB had updated the original modeling assessment submitted on December 19, 2016 after consultation with EPA to

address issues associated with emissions, and averaging of modeled results to be consistent with EPA guidance. PREQB also updated the model from version AERMOD 15181 to the most recent version, AERMOD 1616r. Based on the information at hand in August 2017, the EPA proposed to modify the Puerto Rico's recommended boundaries for the Guayama-Salinas nonattainment area. EPA also proposed to designate a portion of the Guayama-Salinas area as unclassifiable due to uncertainty regarding the extent of air quality modeled violations beyond the receptor grid used by Puerto Rico.

3.3. Assessment of New Air Quality Monitoring Data for the Guayama-Salinas Area

This factor considers the SO_2 air quality monitoring data in the area of Guayama-Salinas area Our TSD for the intended area designations considered available data through 2016 for the Salinas monitor (AQS ID 72-123-0002), and the Guayama monitor (AQS ID 72-057-0009).

As we indicated in the TSD for our intended designations, EPA believes that the data from the monitors did not provide information that could be used to support the designation recommendation for the area since they had not collected enough data for comparison to the NAAQS in recent years, and because the EPA does not have information indicating that they are located in the area of maximum impact.

We do not have certified data for any additional complete calendar years at any site, and we have no new monitoring information of any other type that warrants revising our prior analysis of available monitoring data.

3.4. Assessment of New Air Quality Modeling Analysis for the Guayama-Salinas Area Addressing PREPA Aguirre

3.4.1. Introduction

This section 3.4 presents all the newly available air quality modeling information for the Guayama-Salinas area that includes PREPA Aguirre. (This area will often be referred to as "the Guayama-Salinas area" within this section 3.4.) This area contains the following SO_2 source, principally the source around which Puerto Rico was required by the DRR to characterize SO_2 air quality:

- 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.

On October 23, 2017, and November 1, 2017 PREQB submitted new modeling analyzing air quality in the area surrounding the PREPA Aguirre facility. This new assessment and

characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions.

Based on the information at hand in August 2017, the EPA proposed to modify Puerto Rico's recommended boundaries for the Guayama-Salinas nonattainment area. EPA also proposed to designate a portion of the Guayama-Salinas area as unclassifiable due to uncertainty regarding the extent of air quality modeled violations beyond the receptor grid used by Puerto Rico.

Puerto Rico's analysis supports a different designation for the portion of the Guayama-Salinas area that EPA had intended to designate as unclassifiable. Because PREQB's analysis does not present information showing that this portion contributes to the modeled NAAQS violations, it supports a designation of attainment/unclassifiable for this portion of the Guayama-Salinas area. The analysis, however, does not support a change to EPA's proposed nonattainment area boundaries for the Guayama-Salinas area.

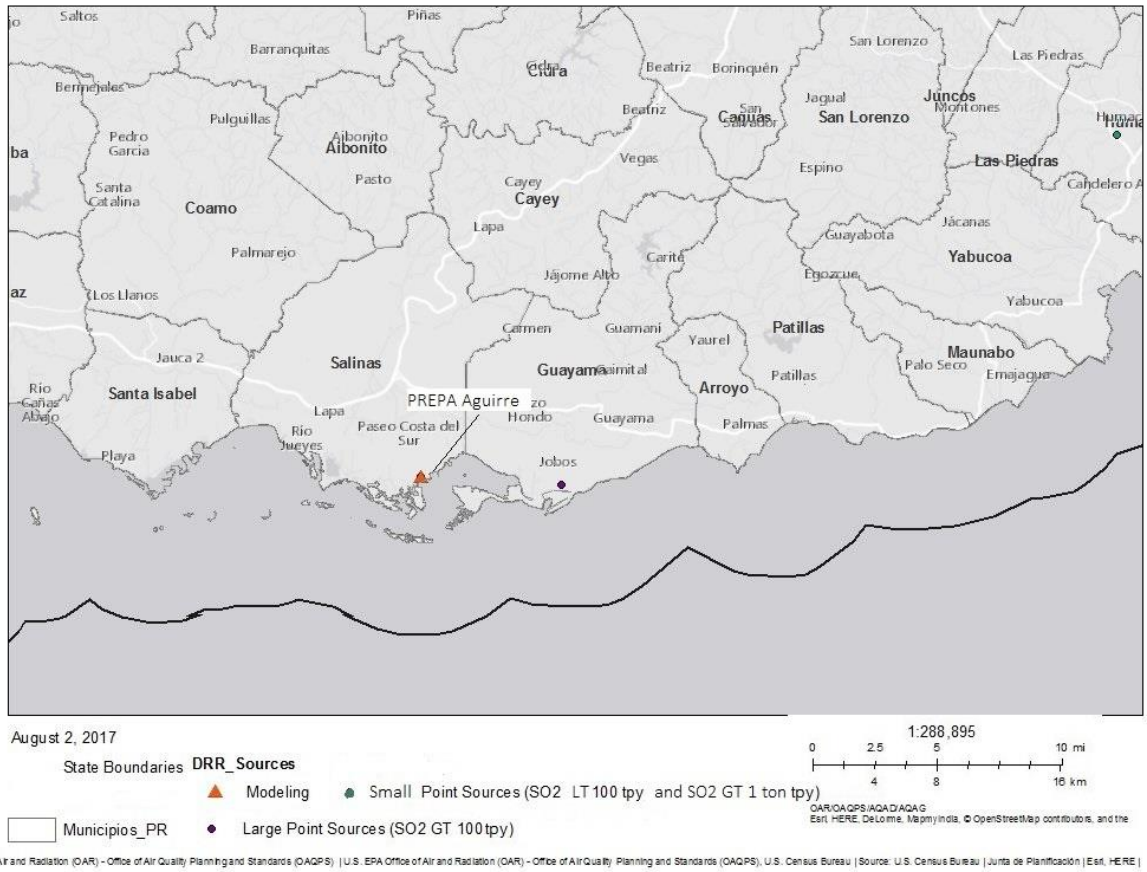
As seen in Figure 10 below, the PREPA Aguirre facility is located in Guayama-Salinas, Puerto Rico, near the southern island coastline. PREPA Aguirre is located near PR 705, the Jobos Bay National Estuarine Research Reserve, and Jobos Bay (Bahia de Jobos) in Salinas.

Also included in the figure are other nearby emitters of SO_2.[13] There is a moderately sized point source, AES Cogen, approximately 8.5 km east of PREPA Aguirre in Guayama. The facility emitted 245 tons of SO_2 in 2014.

The EPA's final designation boundaries for the Guayama-Salinas nonattainment and attainment/unclassifiable areas are not shown in this figure, but are shown in the section below that summarizes our final designation.

[13] All other SO_2 emitters of 1 tpy or more (based on information in the 2014 NEI, Version 1, are shown in Figure 10. There are no additional SO_2 emitters above this emission level in the vicinity of the named source(s).

Figure 10: 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 cited in Chapter 1 of this TSD, as appropriate.

For this area, the EPA received and considered one new modeling assessment, beyond those identified above in Table 7 that were reviewed in its TSD for its intended designations, submitted by Puerto Rico. To avoid confusion in referring to these assessments, the following table describes this assessment, indicating when it was received, providing an identifier for the assessment that is used in the discussion that follows, and identifying any distinguishing features of the modeling assessment.

Table 8 –New Modeling Assessment for the Guayama-Salinas Area

Organization Submitting Assessment	Date of the Assessment	Identifier Used in this TSD	Distinguishing or Otherwise Key Features
PREQB	October 23, 2017 and November 1, 2017[a]	PREPA Aguirre	Met data 2001-2003

[a] The 10/23 submission was limited to modeling results. Modeling files and confirmation of protocol used were provided on 11/01

3.4.2. Differences Among and Relevance of the Modeling Assessments

The new modeling for the Guayama-Salinas area submitted by PREQB has one major difference compared to the 120-day modeling submitted by Puerto Rico. In the previous analysis, there were violating receptors at the edge of the grid. In the new analysis, Puerto Rico extended the boundaries for the receptor grid until there were no violating receptors. All further discussion of the Territory's modeling reflects evaluation of the newer analysis. Even with the larger receptor grid, the overall maximum concentration is the same and occurs at the same receptor as the previous analysis. Most of the following subsections of Section 3.4 are similar to the TSD submitted for the 120-day modeling; except for Section 3.4.5 which discusses the receptor grid.

3.4.3. 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

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

3.4.4. 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.

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

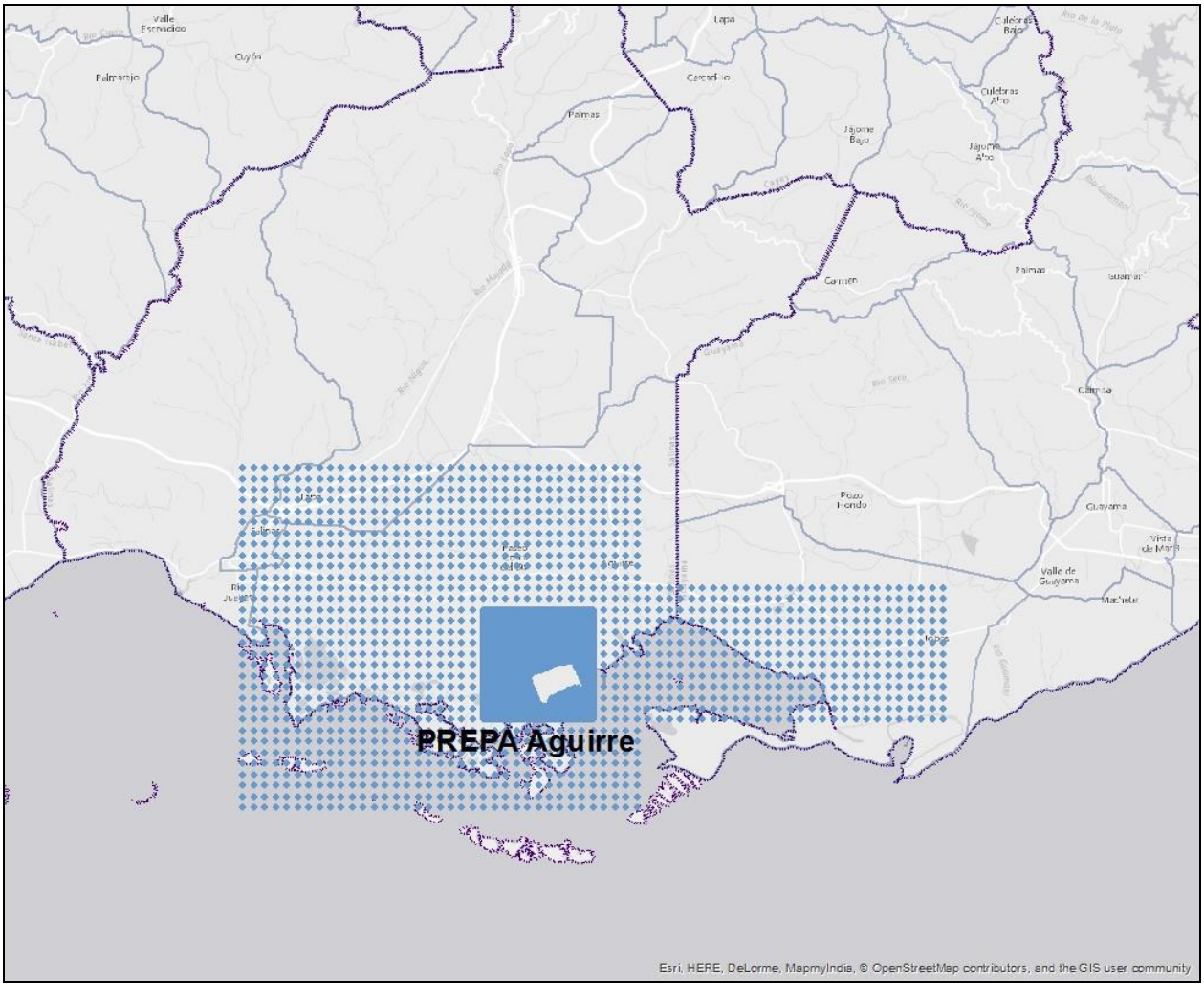
The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location 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 distant 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 fence line.

The receptor network contained 3,918 receptors, and the network covered primarily an area to the north and west of the facility. The grid extended approximately 6.5 km to the west, 2.3 km to the south, 4.5 km to the north, and 8 km to the east of the facility. Figure 11, 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 the modeled facility, including other facilities' property. The Commonwealth also placed receptors in other locations that it considered to be ambient air relative to the 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 fence line were included in each run. An existing fence precluded public access.

Figure 11: Area of Analysis and Receptor Grid for the Guayama-Salinas Area



The updated modeling submitted by Puerto Rico included an expanded receptor grid in the north, south, and west from the previous modeling analysis from March 2017. An extensive coarse and refined Cartesian receptor grid covering the maximum area of impact was included in the modeling.

3.4.6. 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 DRR threshold of 2,000 tons of SO_2 per year.

Puerto Rico characterized this source 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

PREQB 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 accounting for downwash. However, since the area already violated the NAAQS even without accounting for 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 outcome in the area for purposes of this action. However, when developing an attainment plan to address the NAAQS violations, Puerto Rico will need to accurately account for downwash in order to successfully demonstrate that any remedial emissions controls and reductions at these sources will result in NAAQS attainment throughout the nonattainment area.

3.4.7. 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 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, PREQB 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 9. A description of how the Commonwealth obtained hourly emission rates is given below this table.

Table 9. Actual SO_2 Emissions Between 2013 – 2015 from Facilities 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 PREQB RCAP Rule 410 reports and the SO_2 actual emission data submitted and certified by PREPA. PREPA submits the actual emissions reports annually to PREQB 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 PREQB. EPA believes that utilizing fuel usage data is an acceptable method for estimating emissions in the absence of CEMs.

3.4.8. Modeling Parameter: Meteorology and Surface Characteristics

As noted in the Modeling TAD, the most recent 3 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).

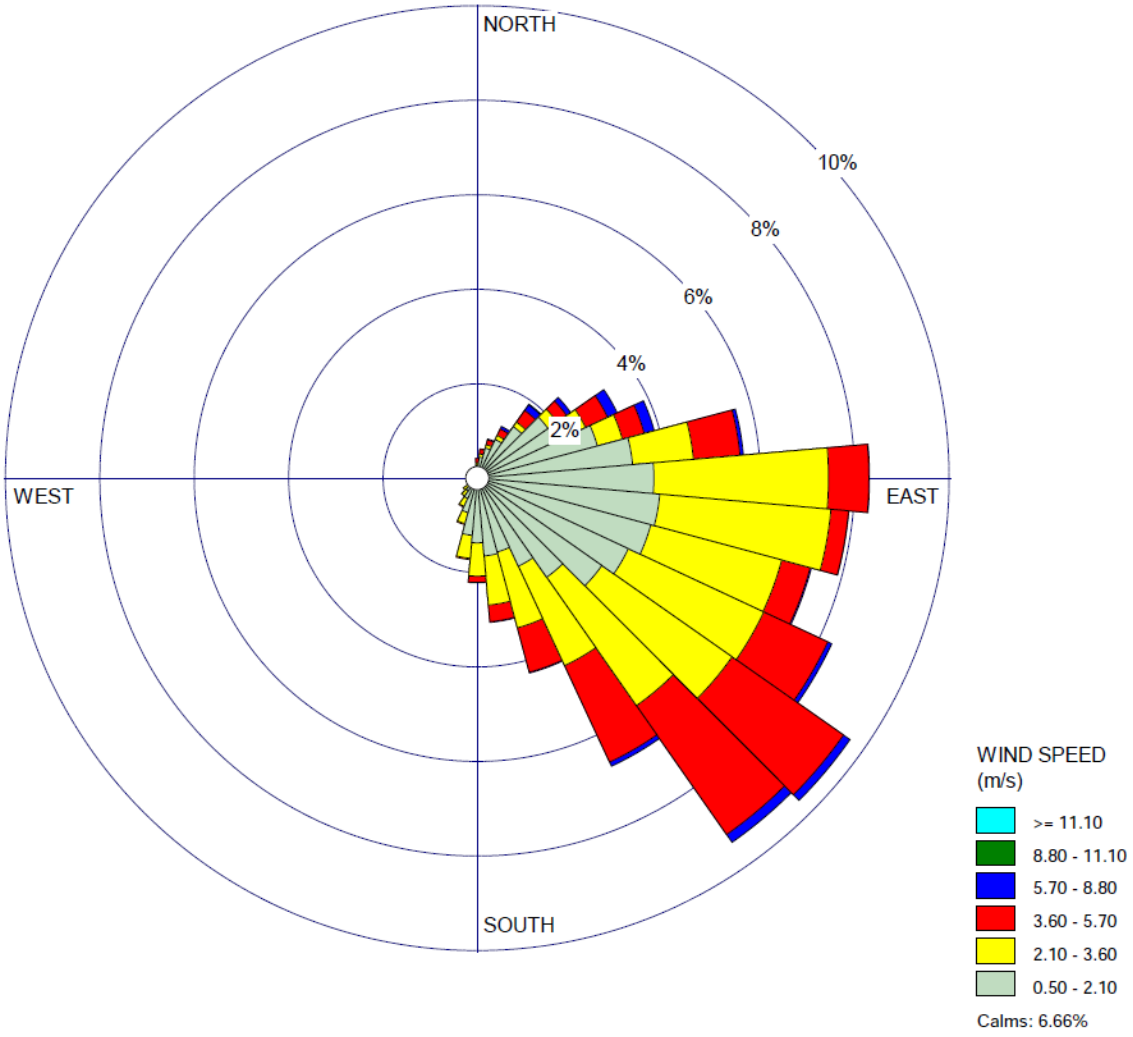
The land cover categories values were obtained by tables given in USEPA *AERSURFACE User Guide* (2008), together with fractions of the total area of interest. The area fractions of land cover classifications were calculated based on observations of satellite maps. All land cover classification system 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 location of this NWS station is shown relative to the area of analysis.

Figure 12: Area of Analysis and the NWS station in the Guayama-Salinas 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 13, 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 13: 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. 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 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 strong easterly trade winds, and 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.

3.4.9. 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.

3.4.10. 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 existing AES Puerto Rico Cogeneration plant in Jobos, Guayama. Using a background monitor in such close proximity to a moderately sized point source resulted in using a relatively conservative background. 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 ($\mu g/m^3$), equivalent to 22 ppb when expressed in 2 significant figures, and that value was 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 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 2008-2010 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 source's impact.

3.4.11. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Guayama-Salinas area of analysis are summarized below in Table 10.

Table 10. 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	3,918
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 11 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

Table 11. Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentration Averaged Over Three Years for the Area of Analysis for the Guayama-Salinas Area

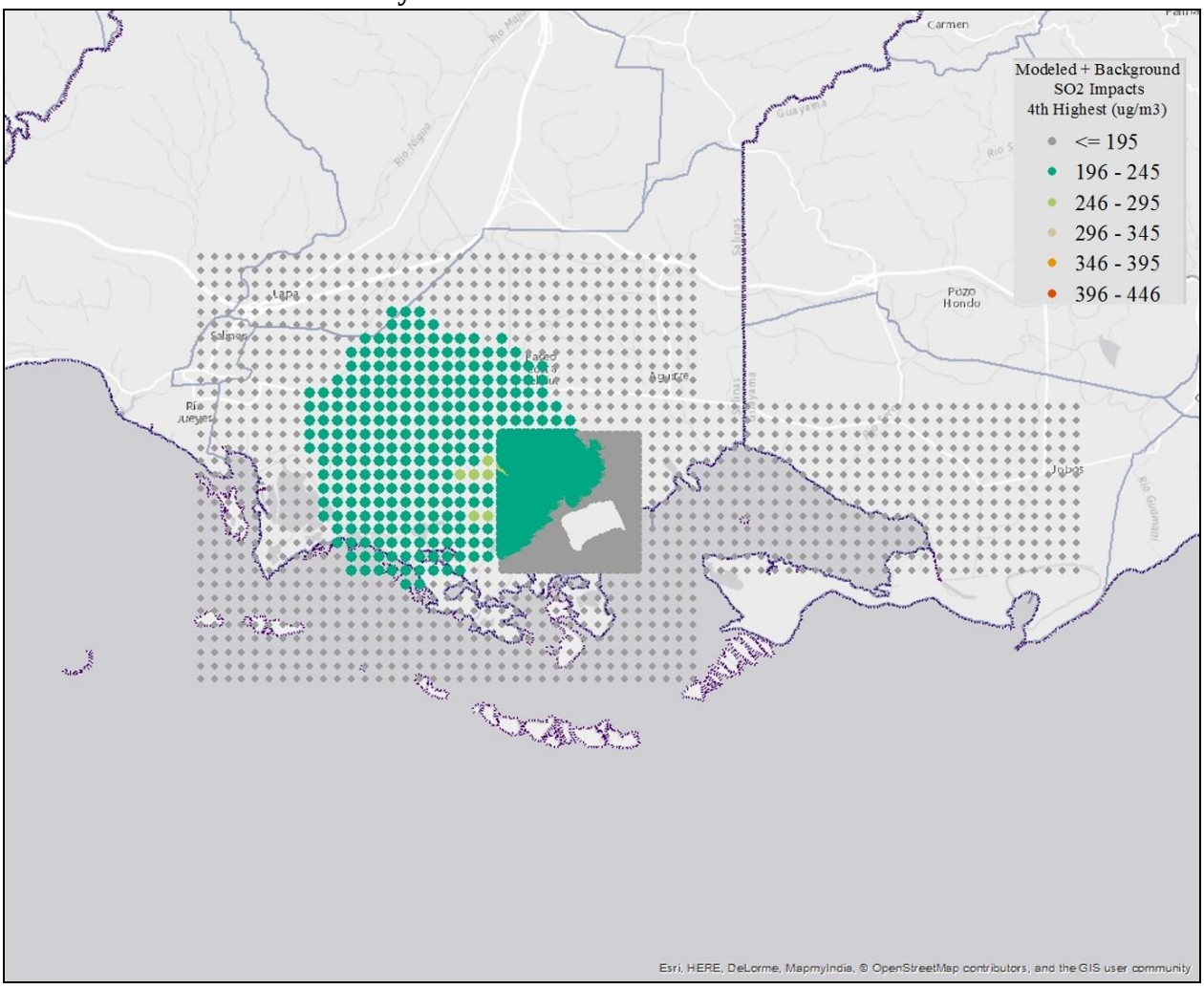
Averaging Period	Data Period	Receptor Location UTM zone 19N		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-2015	791000	1987750	252	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb reflecting 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 to 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 14 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.

Even with the larger receptor grid, the overall maximum concentration is the same and occurs at the same receptor as indicated by the previous analysis discussed in the TSD for the 120-day letter.

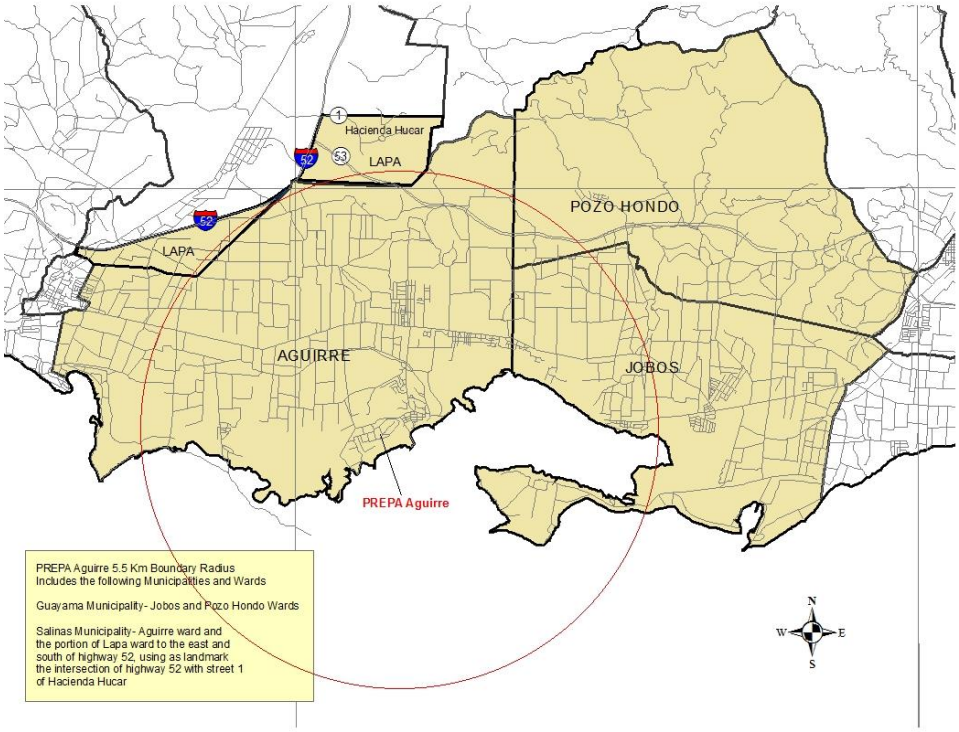
Figure 14: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Guayama-Salinas Area



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. Puerto Rico's recommendation to EPA was based on the municipalities and wards that were within the boundary impact radius, which is the maximum radius of modeled results over the 1-hour SO_2 NAAQS, and is based on the outermost violating receptor.

Figure 15 shows a map with the municipalities and wards recommended by Puerto Rico for the boundary impact radius of PREPA Aguirre. These include the municipalities of Guayama and Salinas. Puerto Rico recommended 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 Puerto Rico's background concentration of 58 $\mu g/m^3$, while EPA is using 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 15: PREPA Aguirre 1-Hour SO_2 Modeling Results Boundary Impact Radius, Years 2013-2015



3.4.12. The EPA's Assessment of the Modeling Information Provided by the Territory

Based on the information provided by Puerto Rico and summarized in Section 3.4, 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

3.5. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Guayama-Salinas 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.

3.6. Jurisdictional Boundaries in the Guayama-Salinas 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 Guayama 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.

EPA believes the municipalities and wards provide clearly defined legal boundaries and align with existing administrative boundaries. EPA's assessment of how the boundaries fit with the modeled violating receptors is further discussed in section 3.8 below.

3.7. Other Additional 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.

3.8. The EPA's Assessment of the Available Information for the Guayama-Salinas Area

The modeling analysis submitted by Puerto Rico to characterize air quality in the area surrounding PREPA Aguirre located in the Salinas municipality, showed violating receptors in the Salinas municipality. Specifically, violating receptors were shown in the Aguirre and Lapas wards.

The predicted SO_2 impacts shown in Figure 14 in the previous section of this TSD does not show violating receptors in the Guayama municipality, including Jobos and Pozo Hondo ward. Puerto Rico had recommended including these additional wards in the Guayama-Salinas nonattainment area based on the boundary impact radius.

The boundary impact radius from the modeling covers only a limited portion of the Guayama and Salinas municipalities area rather than the entire area; a smaller nonattainment area is therefore supported. As mentioned earlier in the TSD, the boundary impact radius as determined by Puerto Rico is based on the outermost violating receptor.

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 background 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.

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 final nonattainment area.

EPA does not believe that Jobos and Pozo Hondo wards in Guayama should be included in the final nonattainment area since they do not contain any violating receptors based on the modeling

and no evidence suggests they are contributing to the modeled NAAQS violations. With the exception of the AES Cogeneration Plant in Jobos, there are no SO_2 point sources above 1 ton per year in either wardIn addition, any contribution from AES would be accounted for in the background concentration that was added to the model.

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 from PREPA Aguirre and the nearest violating receptor) to change the boundaries of the violating area, or provide evidence of contribution. As previously mentioned PREPA Aguirre emitted 9,261 tons of SO_2 in 2014. As shown in figure 14, the distance of the furthest violating receptor on the western boundary of the receptor grid is approximately 4 km from PREPA Aguirre. SO_2 emissions from PREPA Aguirre dwarf the emissions from the AES plant.

EPA had intended to propose the entire Guayama municipality as unclassifiable based on the uncertainty regarding contributions from the AES plant. EPA's further analysis of the emissions and distance to violating receptors our uncertainty regarding contributions from AES.

As mentioned earlier in this TSD, in the previous modeling analysis submitted by PREQB, there were violating receptors at the edge of the grid on the northern, southern, and western boundaries. Based on that uncertainty, EPA had intended to designate thoseboundaries of the Guayama-Salinas area as unclassifiable. In the new analysis, PREQB extended the boundaries for the receptor grid in the north, south, and west until there were no violating receptors. EPA notes that PREQB did not expand the eastern boundary of the grid as there were no violating receptors on the eastern edge of the grid. The pattern of violations in the expanded grid shows the impacts increasing slightly in the north, south, and westward direction. Impacts in the east did not change.

The revised modeling provided by PREQB in the north, south, and west removes the uncertainty regarding the norther, southern, and western boundaries of the Guayama-Salinas area. This area includes the remainder of the Salinas municipality and the entirety of the, Santa Isabel, Coamo, Aibonito, and Cayey municipalities.

3.9. Summary of Our Final Designation for the Guayama-Salinas Area

After careful evaluation of the Puerto Rico's recommendation and supporting information, as well as all available relevant information, the EPA is finalizing the designation of 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 is finalizing the designation of the remainder of the Salinas municipality as well as Santa Isabel, Coamo, Aibonito, Cayey, and Guayama municipalities as attainment/unclassifiable based on the modeling showing no violating receptors in these areas, and no evidence indicating that

they are contributing to the modeled NAAQS violations in the Guayama-Salinas Nonattainment Area. Figure 16 shows the boundary of these final designated nonattainment and attainment/unclassifiable areas.

Figure 16. Boundary of the Final Guayama-Salinas Nonattainment and Attainment/Unclassifiable Area