

Technical Support Document:

Chapter 3

Intended Round 4 Area Designations for the 2010 1-Hour SO₂ Primary National Ambient Air Quality Standard for Kentucky

1. Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA, we, or us) must designate areas as either “nonattainment,” “attainment,” or “unclassifiable” for the 2010 1-hour sulfur dioxide (SO₂) primary national ambient air quality standard (NAAQS) (2010 1-hour SO₂ NAAQS). The CAA defines a nonattainment area as an area that does not meet the NAAQS or that contributes to a nearby area that does not meet the NAAQS. An attainment area is defined by the CAA as any area that meets the NAAQS and does not contribute to a nearby area that does not meet the NAAQS. Unclassifiable areas are defined by the CAA as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS. See CAA section 107(d)(1)(A)(i)-(iii).

In this action, EPA defines a nonattainment area as an area that, based on available information including (but not limited to) monitoring data and/or appropriate modeling analyses, EPA has determined either: (1) does not meet the 2010 1-hour SO₂ NAAQS, or (2) contributes to ambient air quality in a nearby area that does not meet the NAAQS. An attainment/unclassifiable area is defined as an area that, based on available information including (but not limited to) appropriate monitoring data and/or modeling analyses, EPA has determined meets the NAAQS and does not likely contribute to ambient air quality in a nearby area that does not meet the NAAQS. An unclassifiable area is defined as an area for which the available information does not allow EPA to determine whether the area meets the definition of a nonattainment area or the definition of an attainment/unclassifiable area.

EPA is under a December 31, 2020, deadline to designate all remaining undesignated areas as required by the U.S. District Court for the Northern District of California.¹ This deadline is the final of three deadlines established by the court for EPA to complete area designations for the 2010 SO₂ NAAQS. The remaining undesignated areas are: 1) those areas which, under the court order, did not meet the criteria that required designation in Round 2 and also were not required to be designated in Round 3 due to installation and operation of a new SO₂ monitoring network by January 2017 in the area meeting EPA’s specifications referenced in EPA’s SO₂ Data Requirements Rule (DRR),² and 2) those areas which EPA has not otherwise previously designated for the 2010 1-hour SO₂ NAAQS. EPA previously issued guidance on how to appropriately and sufficiently monitor ambient air quality in the “SO₂ NAAQS Designations

¹ *Sierra Club v. McCarthy*, No. 3-13-cv-3953 (SI) (N.D. Cal. Mar. 2, 2015).

² See 80 FR 51052 (August 21, 2015), codified at 40 CFR part 51 subpart BB.

Source-Oriented Monitoring Technical Assistance Document” (SO₂ NAAQS Designations Monitoring TAD).³

In previous final actions, EPA has issued designations for the 2010 1-hour SO₂ NAAQS for most areas of the country.⁴ As mentioned, EPA is under a deadline of December 31, 2020, to designate the areas addressed in this technical support document (TSD) as required by the U.S. District Court for the Northern District of California. We are referring to the set of designations being finalized by the deadline of December 31, 2020, as “Round 4” or the final round of the designations process for the 2010 1-hour SO₂ NAAQS. After these Round 4 designations are completed, there will be no remaining undesignated areas for the 2010 1-hour SO₂ NAAQS.

This TSD addresses designations for all remaining undesignated areas in Kentucky for the 2010 1-hour SO₂ NAAQS. Areas with monitored violations of the NAAQS are explicitly evaluated in this TSD.

Kentucky submitted its first recommendation regarding designations for the 2010 1-hour SO₂ NAAQS on June 2, 2011. Additionally, Kentucky submitted recommendations on September 15, 2016, and January 6, 2017, for Rounds 2 and 3 designations, respectively. The Commonwealth submitted updated recommendations on July 7, 2020, to address more recent air quality monitoring data for monitors that were installed pursuant the DRR. In our intended designations, we have considered all the submissions from the Commonwealth, except where a later submission indicates that it replaces an element of an earlier submission.

Table 1 identifies EPA’s intended Round 4 designations and the areas in Kentucky to which they would apply. It also lists Kentucky’s current recommendations. EPA intends to designate these areas by December 31, 2020, through an assessment and characterization of air quality based primarily on ambient monitoring data, including data from existing and new EPA-approved monitors that have collected data from January 2017 forward, pursuant to the DRR; however, other available evidence and supporting information, such as air dispersion modeling in certain situations, may also be considered.⁵

³ <https://www.epa.gov/sites/production/files/2016-04/documents/so2monitoringtad.pdf>

⁴ Most areas of the U.S. were previously designated in actions published on August 5, 2013 (78 FR 47191), July 12, 2016 (81 FR 45039), December 13, 2016 (81 FR 89870), January 9, 2018 (83 FR 1098) and April 5, 2018 (83 FR 14597). EPA is not reopening these previous designation actions in this current Round 4 of designations under the 2010 1-hour SO₂ NAAQS, except where specifically discussed.

⁵ Detailed SO₂ monitor information may be found in either the 2016 or 2017 ambient monitoring network plans, or associated addenda, for each state.

Table 1. Summary of EPA’s Intended Designations and the Designation Recommendations by Kentucky

Area/County	Kentucky’s Recommended Area Definition	Kentucky’s Recommended Designation	EPA’s Intended Area Definition	EPA’s Intended Designation
Henderson-Webster, Kentucky Area	Henderson County (partial)	Nonattainment	Henderson County (partial); Webster County (partial)	Nonattainment
Remaining portion of Henderson County	N/A	Attainment	Henderson County (partial)	Attainment/Unclassifiable
Remaining portion of Webster County	N/A	Attainment	Webster County (partial)	Attainment/Unclassifiable

Areas that EPA previously designated in Round 1 (*see* 78 FR 47191), Round 2 (*see* 81 FR 45039 and 81 FR 89870), and Round 3 (*see* 83 FR 1098 and 83 FR 14597) are not affected by the designations in Round 4 unless otherwise noted.

2. General Approach and Schedule

An updated designations guidance document was issued by EPA through a September 5, 2019, memorandum from Peter Tsirigotis, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Regional Air Division Directors, U.S. EPA Regions 1-10.⁶ To better reflect the Round 4 designations process, this memorandum supplements, where necessary, prior designations guidance documents on area designations for the 2010 primary SO₂ NAAQS issued on March 24, 2011, March 20, 2015, and July 22, 2016. This memorandum identifies factors that EPA intends to evaluate in determining whether areas are in violation of the 2010 1-hour SO₂ NAAQS. The document also contains the factors that EPA intends to evaluate in determining the boundaries for all remaining areas in the country. These factors include: 1) air quality characterization via ambient monitoring and/or dispersion modeling results; 2) emissions-related data; 3) meteorology; 4) geography and topography; and 5) jurisdictional boundaries.

In EPA’s September 2019 memorandum, we note that Round 4 area designations will be based primarily on ambient monitoring data, including data from existing and new EPA-approved monitors that have collected data at least from January 2017 forward, pursuant to the DRR. In addition, EPA may evaluate air dispersion modeling submitted by state air agencies for two specific circumstances. First, states may submit air dispersion modeling to support the geographic extent of a nonattainment boundary. Second, states may submit air dispersion

⁶ https://www.epa.gov/sites/production/files/2019-09/documents/round_4_so2_designations_memo_09-05-2019_final.pdf

modeling to demonstrate that new permanent and federally enforceable SO₂ emissions limits provide for attainment of the NAAQS and represent a more accurate characterization of current air quality at the time of designation than does monitoring of past air quality.

This TSD is organized such that there is a section for each area in Kentucky for which air quality monitoring data indicate a violation of the 2010 SO₂ NAAQS. When modeling information is available, it is evaluated in the context of that section. For some counties, multiple portions of the county have monitoring or modeling information available and the section on the county is divided accordingly. EPA does not plan to revise this intended designations TSD after consideration of state and public comment on our intended designation. A separate final TSD will be prepared as necessary to document how we have addressed such comments in the final designations.

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

- 1) 2010 1-hour SO₂ NAAQS – The primary NAAQS for SO₂ promulgated in 2010. This NAAQS is 75 parts per billion (ppb), based on the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentrations. See 40 CFR 50.17.
- 2) Design Value - a statistic computed according to the data handling procedures of the NAAQS (in 40 CFR part 50 Appendix T) that, by comparison to the level of the NAAQS, indicates whether the area is violating the 2010 1-hour SO₂ NAAQS.
- 3) Intended designated nonattainment area –an area that, based on available information including (but not limited to) monitoring data and/or appropriate modeling analyses, EPA intends to determine either: (1) does not meet the 2010 1-hour SO₂ NAAQS, or (2) contributes to ambient air quality in a nearby area that does not meet the NAAQS.
- 4) Intended designated attainment/unclassifiable area – an area that, based on available information including (but not limited to) appropriate monitoring data and/or appropriate modeling analyses, EPA intends to determine meets the 2010 1-hour SO₂ NAAQS and does not likely contribute to ambient air quality in a nearby area that does not meet the NAAQS.
- 5) Intended designated unclassifiable area – an area for which the available information does not allow EPA to determine whether the area meets the definition of a nonattainment area or the definition of an attainment/unclassifiable area.
- 6) Modeled violation – a modeled design value impact above the 2010 1-hour SO₂ NAAQS demonstrated by air dispersion modeling.
- 7) Recommended attainment area – an area that a state, territory, or tribe has recommended that EPA designate as attainment.
- 8) Recommended nonattainment area – an area that a state, territory, or tribe has recommended that EPA designate as nonattainment.
- 9) Recommended unclassifiable area – an area that a state, territory, or tribe has recommended that EPA designate as unclassifiable.
- 10) Recommended attainment/unclassifiable (or unclassifiable/attainment) area – an area that a state, territory, or tribe has recommended that EPA designate as attainment/unclassifiable (or unclassifiable/attainment).

- 11) Violating monitor – an ambient air monitor meeting 40 CFR parts 50, 53, and 58 requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.
- 12) We, our, and us – these refer to EPA.

3. Technical Analysis for the Henderson-Webster, Kentucky Area

3.1. Introduction

EPA must designate the Henderson-Webster, Kentucky Area by December 31, 2020, because the Area has not been previously designated, and Kentucky began operating a new EPA-approved monitor pursuant to the DRR. This section presents all the available air quality information for the portions of Henderson and Webster Counties that include the following SO₂ sources around which the DRR required the Commonwealth to characterize air quality:

- The Century Aluminum Sebree LLC (Century Aluminum) facility emits 2,000 tons or more of SO₂ annually. Specifically, Century Aluminum emitted 4,739 tons of SO₂ in 2014. This source meets the DRR criteria and thus is on the SO₂ DRR Source list, and Kentucky has chosen to characterize it via monitoring.
- The Big Rivers Electric Corporation's Robert A. Reid Station/Henderson Municipal Power and Light (HMP&L) Station 2 (BREC Reid/HMP&L Station 2) facility emits 2,000 tons or more of SO₂ annually. Specifically, BREC Reid HMP&L Station 2 emitted 12,202 tons of SO₂ in 2014. This source meets the DRR criteria and thus is on the SO₂ DRR Source list, and Kentucky has chosen to characterize it via monitoring.
- The Big Rivers Electric Corporation's Robert D. Green Station emits 2,000 tons or more of SO₂ annually. Specifically, BREC Green Station emitted 3,999 tons of SO₂ in 2014. This source meets the DRR criteria and thus is on the SO₂ DRR Source list, and Kentucky has chosen to characterize it via monitoring.

The Sebree DRR monitor (AQS ID: 21-101-1011) was sited to characterize the maximum 1-hour SO₂ concentrations in the area surrounding all three DRR sources mentioned above. As seen in Figure 1 and Figure 2 below, all 3 facilities are located less than 2 kilometers (km) from the violating monitor in Henderson County, Kentucky. Century Aluminum is located to the northeast of the violating monitor in Henderson County. The BREC Reid/HMP&L Station 2 and the BREC Green Station are both located in Webster County to the southeast of the monitor and both facilities are owned by the Big Rivers Electric Corporation (BREC). Additionally, the Robert A. Reid Station/HMP&L Station 2 is a single stationary source with one operating permit, however two of the coal-fired units at the facility are owned by HMP&L and operated by BREC.

Figure 1. Map of the Henderson-Webster County, Kentucky Area Addressing Century Aluminum, BREC Reid/HMP&L Station 2, and BREC Green Station

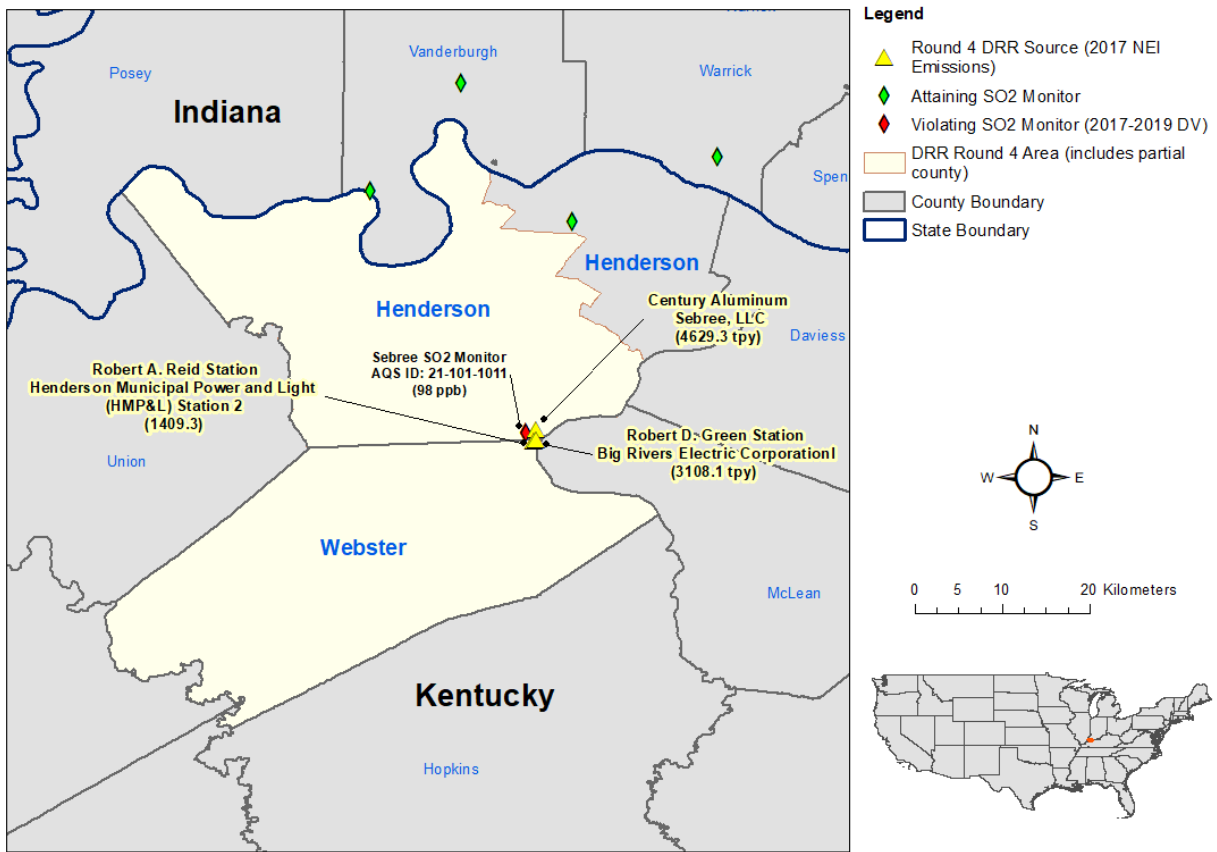
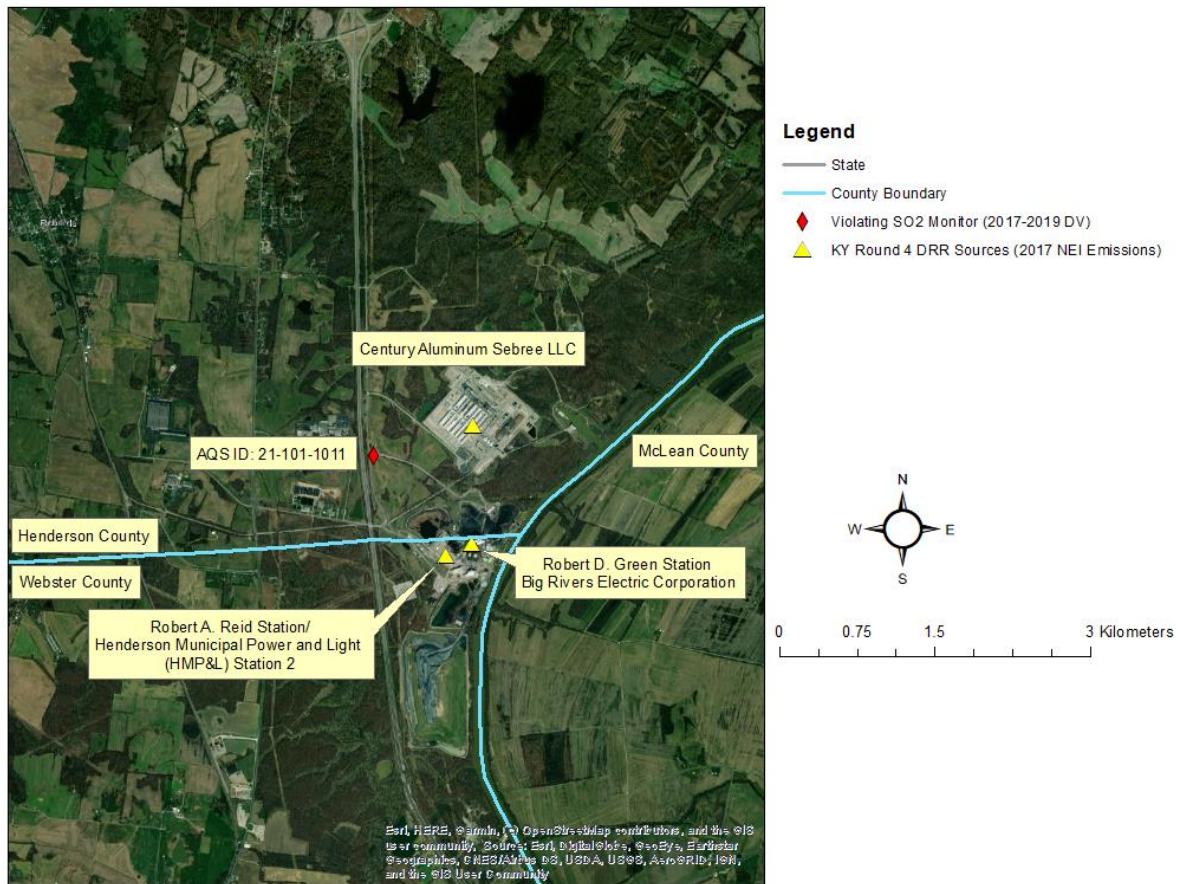


Figure 2. Close-up Image of the Henderson-Webster County, Kentucky Area, including Century Aluminum, BREC Reid/HMP&L Station 2, and BREC Green Station



In its July 7, 2020, recommendation letter, Kentucky recommended that a portion of Henderson County be designated as nonattainment for the 2010 1-hour SO₂ NAAQS, based on monitored air quality from 2017-2019. Kentucky recommended that the remainder of Henderson County and all of Webster County be designated attainment for the 2010 1-hour SO₂ NAAQS. Specifically, the Commonwealth’s recommended nonattainment boundary for Henderson County consists of the area located between Edward T. Breathitt Pennyrile Parkway (to the west) and the Green River (to the east), south of Moss and Moss Road, and north of the Century Aluminum railroad spur and Big Rivers Electric coal haul road as shown in Figure 8. EPA agrees with Kentucky’s recommendation to the extent that some portion of Henderson County be designated nonattainment; however, EPA intends to change Kentucky’s recommendation as to the designation boundary for Henderson County. Additionally, EPA intends to change Kentucky’s recommendation for a portion of Webster County. Specifically, EPA intends to designate portions of Henderson and Webster Counties in Kentucky, as described below, as one contiguous nonattainment area for the 2010 1-hour SO₂ NAAQS, based upon currently available monitoring information for the 2017-2019 period that is violating the 1-hour SO₂ NAAQS and an evaluation of SO₂ emissions sources that are causing or contributing to the monitored violations. Our

intended boundary is different than the Commonwealth’s recommended boundary and is described below.

3.2. Air Quality Monitoring Data for the Henderson-Webster, Kentucky Area

EPA considered the design value for the air quality monitor in the Henderson-Webster, Kentucky Area by assessing the most recent 3 consecutive years (i.e., 2017-2019) of quality-assured, certified ambient air quality data in EPA’s Air Quality System (AQS) using data from the Federal Reference Method and Federal Equivalent Method monitor that is sited and operated in accordance with 40 CFR parts 50 and 58.⁷ Procedures for using monitored air quality data to determine whether a violation has occurred are given in 40 CFR part 50 Appendix T, as revised in the 2010 1-hour SO₂ NAAQS rulemaking. The 2010 1-hour SO₂ NAAQS is met when the design value is 75 ppb or less. Whenever several monitors are located in an area, the design value for the area is determined by the monitor with the highest valid design value. The presence of one or more violating monitors (i.e., monitors with design values (dv) greater than 75 ppb) in a geographic area forms the basis for designating that area as nonattainment. There is only one air quality monitor in this area. The remaining factors, described in the next section, are then used as the technical basis for determining the spatial extent of the designated nonattainment area surrounding the violating monitor. Table 2 contains the 2017-2019 design value for the area of analysis.

Table 2. 2010 1-Hour SO₂ NAAQS Design Value for the Henderson-Webster, Kentucky Area

AQS Site ID	Monitor Location	2017 99 th Percentile (ppb)	2018 99 th Percentile (ppb)	2019 99 th Percentile (ppb)	2017-2019 Design Value (ppb)
21-101-1011	37.65438, -87.51143 Alcan Aluminum Road, Robards, KY 42452	94	102	99	98

Data collected at this monitor indicates that the Area has a complete, valid 2017-2019 design value that is violating the 2010 1-hour SO₂ NAAQS. Therefore, a portion of the area must be designated nonattainment because of the violating monitor.

3.3. Intended Designation Boundary Determination

EPA must designate as nonattainment any area that violates the NAAQS and any nearby area that contributes to ambient air quality in the violating area. The Sebree SO₂ DRR monitor in Henderson County shows a violation of the 2010 1-hour SO₂ NAAQS based on data collected between 2017 and 2019, and, therefore, some area around the violating monitor must be

⁷ SO₂ air quality data are available from EPA’s website at <https://www.epa.gov/outdoor-air-quality-data>. SO₂ air quality design values are available at <https://www.epa.gov/air-trends/air-quality-design-values>.

designated nonattainment. In this section, we consider the appropriate geographical extent of the nonattainment area.

A nonattainment area should contain the area violating the NAAQS (e.g., the area around a violating monitor or encompassing modeled violations), as well as any nearby areas (e.g., counties or portions thereof) that contain emissions sources contributing to ambient air quality in the violating area. (*See* CAA section 107(d)(1)(A)(i)). Accordingly, although EPA considers county boundaries as the analytical starting point for determining SO₂ nonattainment areas, an evaluation of five factors for each area may be considered in determining the geographic scope of a nonattainment boundary.

Thus, the boundary for the area was evaluated using five factors: 1) ambient air quality data or dispersion modeling results; 2) emissions-related data; 3) meteorology; 4) geography and topography; and 5) jurisdictional boundaries, as well as other relevant available information. While the factors are presented individually, they are not independent. Instead, the five-factor analysis process carefully considers their interconnections and the dependence of each factor on one or more of the others.

Kentucky submitted an analysis of all of these five factors to support the geographic scope of its recommended boundary. EPA has attempted to supplement information from the Commonwealth, where necessary.

3.3.1. Factor 1: Ambient Air Quality Data and Dispersion Modeling Results

Ambient air quality data are discussed in the previous section. Kentucky did not provide comprehensive air dispersion modeling to assess the geographic extent of the sources' impacts that are causing the monitored NAAQS violations at the Sebree SO₂ DRR monitor in the Henderson-Webster, Kentucky Area. However, in their July 7, 2020, recommendation letter, Kentucky provided the results of two limited modeling analyses to support their boundary recommendation:

- (1) Results of HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) trajectory modeling, which is a simplified modeling analysis that provides information on pollutant transport based solely upon meteorology and wind measurements but does not consider atmospheric dispersion of pollutants. The details of the HYSPLIT trajectory analysis are discussed in Section 3.3.3, Factor 3: Meteorology.
- (2) Results of a limited dispersion modeling analysis performed to evaluate the SO₂ impacts from one of the three sources in the area subject to the requirements of the DRR, the BREC Green Station. The results of this dispersion analysis are discussed below in Section 3.3.1.a.

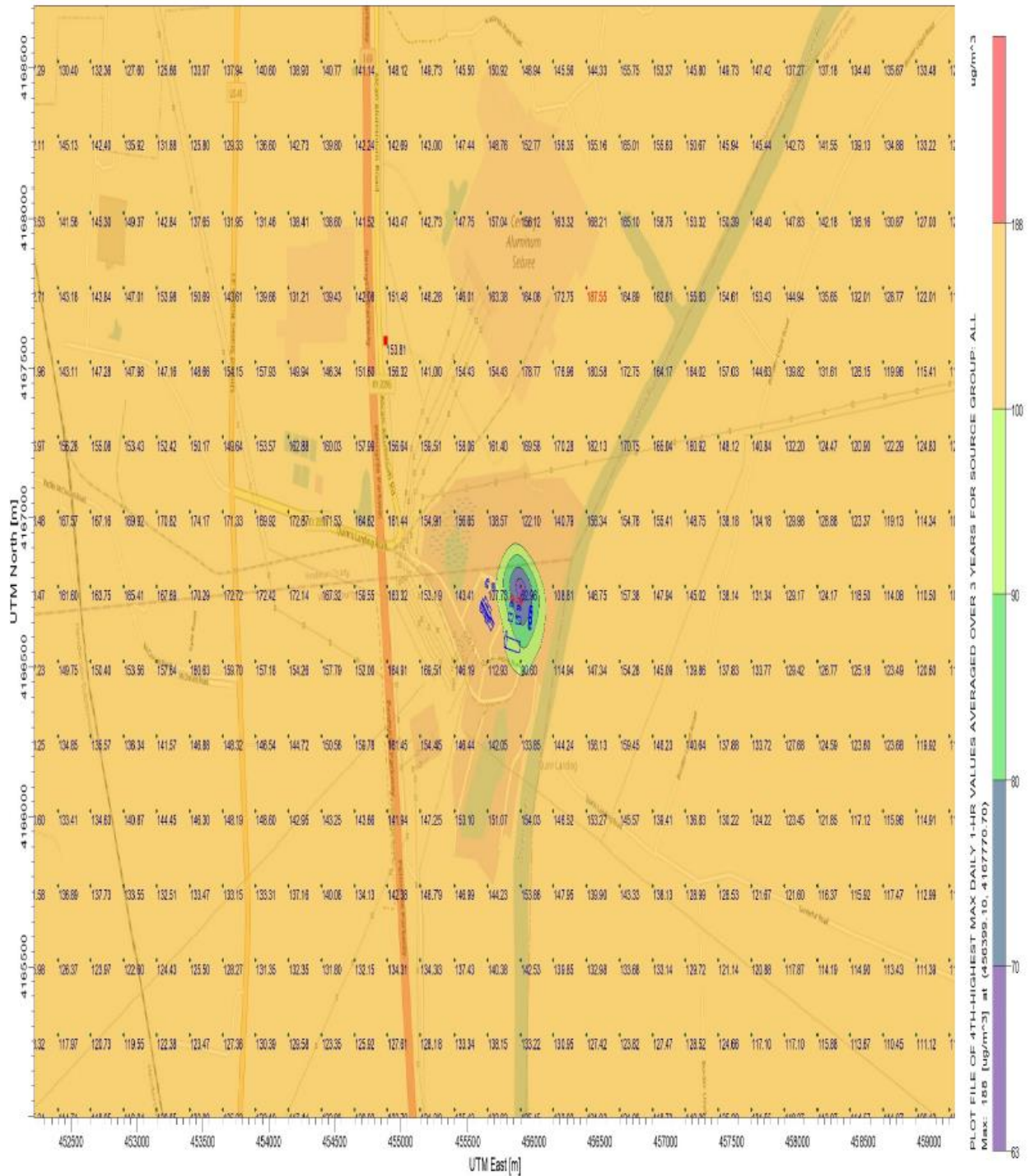
In addition to the information in Kentucky's July 7, 2020, recommendation letter, to inform EPA's selection of its intended nonattainment area boundary, EPA separately evaluated Kentucky's air dispersion modeling analysis that was used to site the Sebree monitor in 2016. This modeling was submitted to EPA in 2016 in Kentucky's Annual Monitoring Network Plan.

A brief summary of this modeling and EPA's analysis of it for the boundary selection is provided in Section 3.3.1.b.

3.3.1.a. Kentucky's July 7, 2020, Limited Dispersion Modeling Analyses

Appendix B of Kentucky's July 7, 2020, recommendation letter, briefly summarizes dispersion modeling performed to determine if SO₂ emissions from BREC Green Station influenced the monitored violations. Kentucky's letter indicates that the modeling used 2017-2019 emissions and 2017-2019 meteorological data. Three scenarios were evaluated. Modeled concentrations from BREC Green Station in combination with: (1) no background concentration, (2) the background concentration from the Baskett monitor (12 ppb design value (DV)), and (3) the background concentration from the Owensboro monitor (24 ppb DV). The results of all three modeling scenarios showed maximum impacts from BREC Green Station emissions combined with the background concentrations were below the 2010 1-hour SO₂ NAAQS and located east of the Sebree SO₂ DRR monitor. Figure 3 copied from Kentucky recommendation letter shows the results from Scenario 3.

Figure 3. Kentucky BREC Green Station Dispersion Modeling Results from Scenario 3 (background concentration from the Owensboro monitor (24 ppb DV))



Kentucky concluded from the limited dispersion modeling that BREC Green Station is not causing a violation of the 2010 1-hour SO₂ NAAQS. However, Kentucky has not provided enough detail about the modeling analysis for EPA to fully evaluate the modeling and the

conclusions being drawn from the results. Additional supporting information would be needed to perform a complete evaluation of the modeling, including copies of all modeling input and output files in electronic format and the complete details of the emissions, source parameters, and meteorology used in the modeling.

While the modeling results could help demonstrate that the emissions solely from the BREC Green Station are not causing the violations of the 1-hour SO₂ NAAQS at the Sebree monitor, nonattainment areas are not limited to including sources that cause violations of a NAAQS, but should also include sources that contribute to violations (i.e., BREC Reid/HMP&L Station 2 and BREC Green Station). CAA section 107(d)(1)(A)(i) states that designations of nonattainment areas should include “any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.” As shown in Figure 3, the results of Kentucky’s modeling show that the impacts from the BREC Green Station emissions are likely greater than 100 micrograms per cubic meter (µg/m³), and could be as high as 188 µg/m³, in the vicinity of the Sebree monitor, when background concentrations are included. As stated above, EPA does not have enough supporting information to fully evaluate the technical merits of the modeling. Regardless, working under the assumption that the modeling and its results are valid, EPA would reach a different conclusion from Kentucky about inclusion of the BREC Green Station in the nonattainment boundary because the modeling results show that it is likely contributing to violations of the 2010 1-hour SO₂ NAAQS in the area.

3.3.1.b. Kentucky’s 2016 Dispersion Modeling used to site the Sebree Monitor

Appendix H of Kentucky’s 2016 Annual Ambient Air Monitoring Network Plan (2016 Network Plan)⁸ contains the results of modeling performed to determine the best location for an ambient air monitor to evaluate the maximum SO₂ concentrations in the area near the three DRR sources identified in Section 3.1 of this TSD (Century Aluminum, BREC Reid/HMP&L Station 2 and BREC Green Station). The modeling was performed using AERMOD version 15181, following the procedures recommended in EPA’s SO₂ NAAQS Designations Monitoring TAD dated February 2016, and EPA’s “SO₂ NAAQS Designations Modeling Technical Assistance Document,” (SO₂ Modeling TAD), dated February 2016. EPA reviewed the modeling in 2016 as part of the process for siting the DRR monitor in order to characterize all three DRR sources and determined that the modeling procedures and results were acceptable. On October 25, 2016, EPA sent a letter to Kentucky approving their 2016 annual network plan,⁹ including approval of the proposed Sebree SO₂ monitor location.

The AERMOD modeling was performed using the rural dispersion option with 2012-2014 actual emissions from the three DRR sources in the area, Century Aluminum, BREC Reid/HMP&L Station 2, and BREC Green Station. Building downwash was evaluated with BPIPPRM version 04274 processor. No other SO₂ emissions sources were included in the modeling. 2012-2014

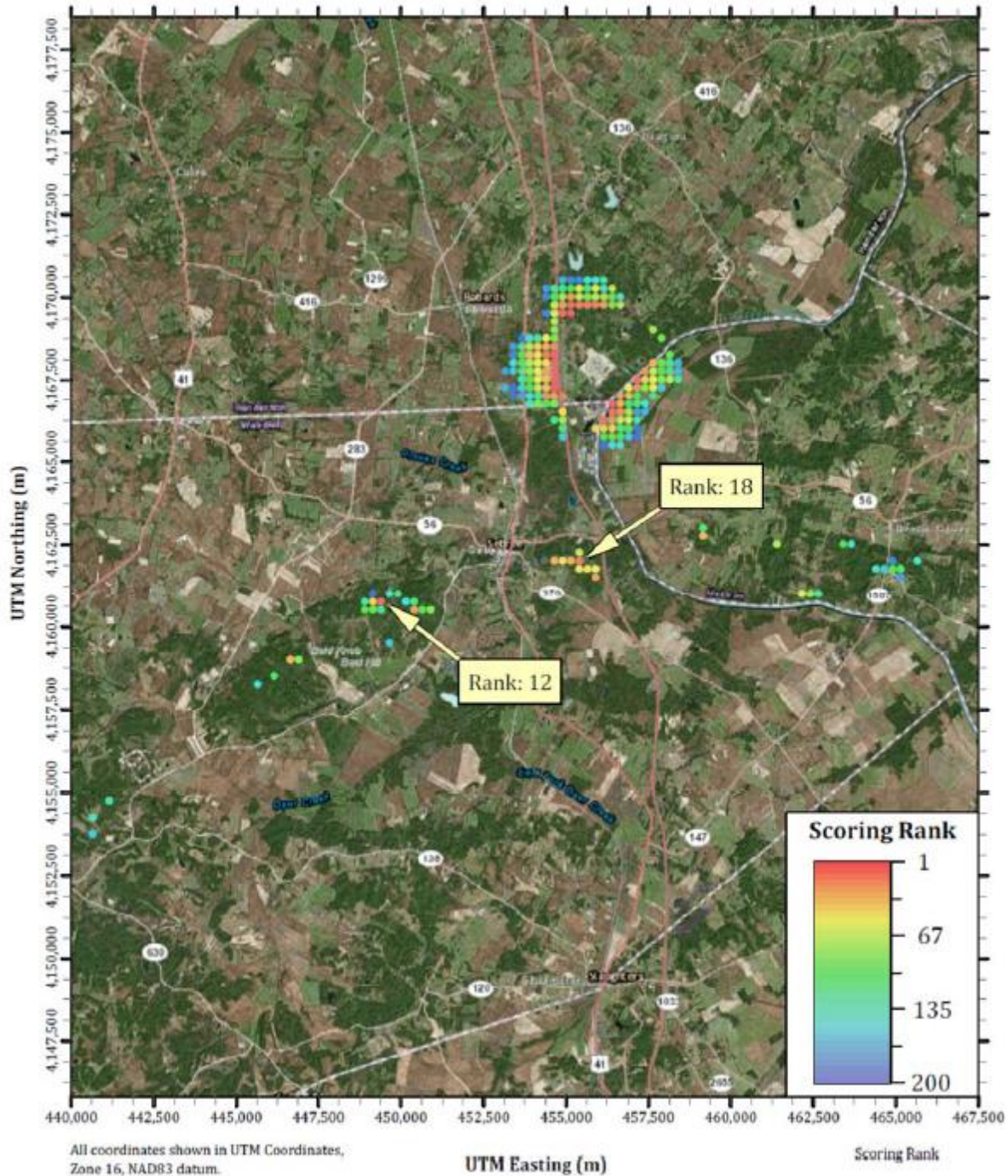
⁸ Kentucky Annual Ambient Air Monitoring Network Plan 2016, Prepared by the Kentucky Division for Air Quality, dated June 27, 2016.

⁹ Letter from Jeanne Gettle, Acting Director, Air, Pesticides and Toxics Management Division, EPA Region 4, to Sean Alteri, Director, Kentucky Division for Air Quality, Kentucky Department for Environmental Protection, dated October 25, 2016.

meteorology from Evansville Regional Airport (surface data) and Nashville International Airport (upper-air data) were processed with AERMET version 15181 and AERMINUTE version 15272. The receptor grid used for the modeling extended 20 km in each direction from the DRR sources. Terrain elevations were included using the AERMAP version 11103 processor.

In accordance with the recommendations in the SO₂ NAAQS Designations Monitoring TAD, the modeling results were presented using normalized design values, which were calculated by dividing the 99th percentile modeled concentrations at each receptor by the maximum modeled design value concentration. Therefore, the modeled concentrations provide a relative ranking of the highest concentrations in the area but do not present absolute modeled impacts. Additionally, following the recommendations in the SO₂ NAAQS Designations Monitoring TAD, an analysis of the frequency of occurrence of high modeled impacts was performed. Figure 4 from the modeling report in Kentucky's Annual Network Plan provides the ranking of the top 200 receptors considering the normalized design values and the frequency of impact.

Figure 4. Results of Modeling Performed to Site the Sebree Monitor Showing the Top 200 Receptors Ranked by Normalized Design Value and Maximum Frequency of Impact (From Kentucky's 2016 Annual Ambient Air Monitoring Network Plan)



As can be seen in Figure 4, highly ranked receptors occur at locations in both Henderson and Webster Counties. As discussed above, the normalized design values from the modeling do not identify areas that have modeled violations of the 1-hour SO₂ NAAQS, but when considered in

combination with the monitored violations of the NAAQS measured at the Sebree monitor, they indicate the potential for elevated SO₂ concentrations extending well beyond the nonattainment boundary proposed by Kentucky.

3.3.2. Factor 2: Emissions-Related Data

Kentucky indicated that in the area surrounding the Sebree SO₂ DRR monitor, there are a number of relatively small SO₂ sources located within a 20 km radius, but that the three DRR facilities were the only sources that emitted greater than one ton of SO₂ from 2017-2019. Kentucky provided the 2017-2019 actual emissions data for the DRR facilities and EPA supplemented the emissions data with 2014-2016 emissions data as seen in Table 3 below. The 2014-2016 emissions are from EPA’s Emission Inventory System (EIS) for Century Aluminum and continuous emissions monitoring (CEMS) data available from EPA’s Clean Air Markets Division (CAMD) for BREC Reid/HMP&L Station 2 and BREC Green Station. Table 4 shows the SO₂ emissions by unit (from CAMD) for the BREC Reid/HMP&L Station 2, and BREC Green Station facilities. Century Aluminum is not required to report to CAMD and therefore is not included in Table 4.

Table 3. SO₂ Emissions of Sources in the Henderson-Webster, Kentucky Area

Facility Name	2014 SO₂ Emissions (tons)	2015 SO₂ Emissions (tons)	2016 SO₂ Emissions (tons)	2017 SO₂ Emissions (tons)	2018 SO₂ Emissions (tons)	2019 SO₂ Emissions (tons)
BREC Reid/HMP &L Station 2	12,202	2,731	2,201	1,409	848	20
BREC Green Station	3,999	3,032	2,682	3,108	4,114	2,916
Century Aluminum	4,739	4,853	4,739	4,629	4,239	4,315

Table 4. SO₂ Emissions of Sources by Unit in the Henderson-Webster, Kentucky Area

Facility Name	Unit ID	2014 SO ₂ Emissions (tons)	2015 SO ₂ Emissions (tons)	2016 SO ₂ Emissions (tons)	2017 SO ₂ Emissions (tons)	2018 SO ₂ Emissions (tons)	2019 SO ₂ Emissions (tons)
BREC Reid	R1	5741.995	13.223	0*	0*	0*	0*
	RT	1.164	1.085	2.44	1.269	1.698	2.89
HMP&L Station 2	H1	2746.462	1895.977	950.309	591.429	423.626	7.588
	H2	3712.409	820.315	1247.833	816.505	423.012	9.374
BREC Green Station	EU01G1	2365.051	1833.094	1853.158	2334.325	2689.436	2163.189
	EU02G2	1634.431	1198.597	828.377	773.649	1424.774	752.679

* There are no emissions data reported to CAMD for this unit for these years. Kentucky’s submittal indicates that unit R1 has not reported any SO₂ emissions since 2015.

BREC owns all the EGUs at BREC Reid/HMP&L Station 2 and BREC Green Station. The BREC Reid Station/HMP&L Station 2 is a single, stationary electric power generating source in Webster County operating under one title V permit. However, two of the coal-fired units at the facility are owned by HMP&L but operated by BREC. In its submission, the Commonwealth informed EPA that as of February 1, 2019, BREC retired the two HMP&L Station 2 units. The retirement was the result of the City of Henderson, Kentucky, and BREC choosing not to renew their contract agreement. The emissions presented in Table 4 for the two HMP&L Station 2 units are from January 2019. EPA confirmed that CAMD does not have emissions reported for the remainder of 2019 for HMP&L Station 2.

Additionally, Kentucky indicated that Reid 1 (Unit ID: R1) at BREC Reid/HMPL&L Station 2 has not operated since 2016 and reported zero SO₂ emissions for 2017-2019. EPA confirmed that CAMD does not have emissions for this unit from 2016-2019, indicating that he BREC Reid R1 unit has not reported any SO₂ emissions since 2015.

On September 10, 2013, BREC of Henderson, Kentucky applied to the Commonwealth for a significant revision to their current title V permit. This permitting action changed the fuel from coal/petroleum coke to natural gas for Reid Unit 01 (Emission Unit 01) at BREC Reid/HMP&L Station 2. The change replaced the existing coal-fired burners with four (4) new natural gas-fired low nitrogen oxide (NOx) burners or equivalent. The permit revision was effective May 27, 2015, with the permit expiration date of September 28, 2016. The Reid unit at BREC Reid/HMP&L Station 2 is currently operating under a title V permit application shield. The source was due for a renewal in 2016 and did submit a timely application that same year. Additionally, there have been discussions about combining the BREC Reid and BREC Green Station. Kentucky is waiting for all of these matters to be resolved before issuing the permit renewal.

BREC Green Station is an electric power generating station in Webster County, Kentucky, consisting of two pulverized coal-fired boilers; Emissions Unit 01 (EU01G1) and Emissions Unit

02 (EU02G2). EU01G1 and EU02G2 each have an input capacity of 2,660 MMBtu/hr. Both of these units are wall-fired, equipped with an electrostatic precipitator, flue gas desulfurization, low NO_x burners, and coal reburn technology.

3.3.3. Factor 3: Meteorology

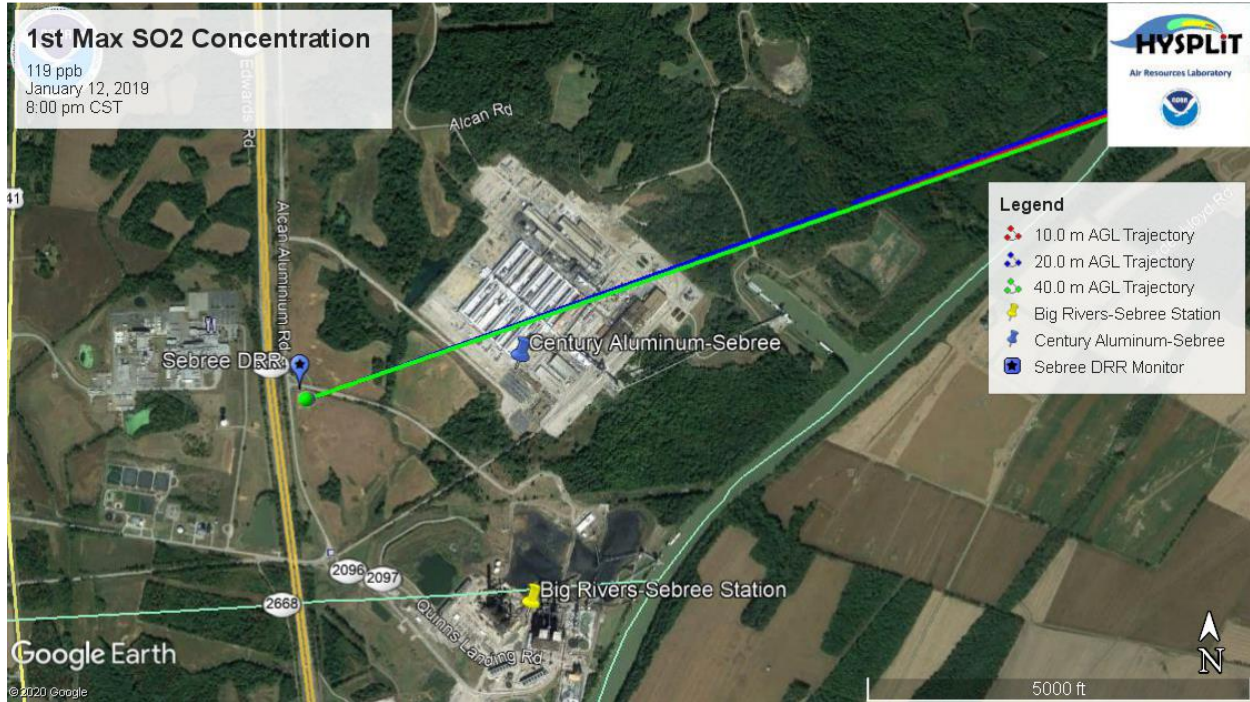
Evidence of source-receptor relationships between specific emissions sources and high SO₂ concentrations at violating monitors is another important factor in determining the appropriate contributing areas and the appropriate extent of EPA's intended nonattainment area.

Kentucky provided an analysis of the meteorology (*e.g.*, weather and transport patterns) for the Henderson-Webster, Kentucky Area. EPA also evaluated meteorological data to determine how weather conditions, including wind speed and direction, affect the plume of sources contributing to the ambient SO₂ concentrations.

Kentucky used the National Atmospheric and Oceanic Administration's (NOAA) HYbrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model to review and understand weather patterns at hours of maximum observed SO₂ concentrations at the Sebree SO₂ DRR monitor. HYSPLIT is a model that helps explain how, when, and where potentially harmful materials are atmospherically transported, dispersed, and deposited. Kentucky's use of HYSPLIT was limited to the backward trajectory feature, which simulates atmospheric transport of pollutants using prognostic (model generated) wind data. The backward trajectories show where winds originated in the hours before exceedances of the 2010 1-hour SO₂ NAAQS were measured at the Sebree monitor. The trajectory modeling does not account for dispersion and deposition of pollutants. Figures 1-12 in Kentucky's July 7, 2020, submittal show HYSPLIT back trajectories originating at the Sebree SO₂ DRR monitor for hours that exceeded the 1-hour SO₂ NAAQS in 2017-2019. Figure 5 below is one of the HYSPLIT figures from Kentucky's submittal, which is representative of these twelve figures from Kentucky's submittal. Note that in Kentucky's submittal, the BREC facilities (BREC Green Station and BREC Reid/HMP&L Station 2) are identified as "Big Rivers – Sebree Station" on all the HYSPLIT figures. As shown in the legend of Figure 5, Kentucky used HYSPLIT to evaluate back trajectories originating at 10 meters (m), 20 m and 40 m above ground level (AGL) at the location of the Sebree monitor. These heights are representative of "surface level" concentrations that are measured by the monitor. Kentucky relied upon these HYSPLIT back trajectories to conclude that "the Century Aluminum Sebree facility is culpable for the monitored violations in 2017-2019."¹⁰

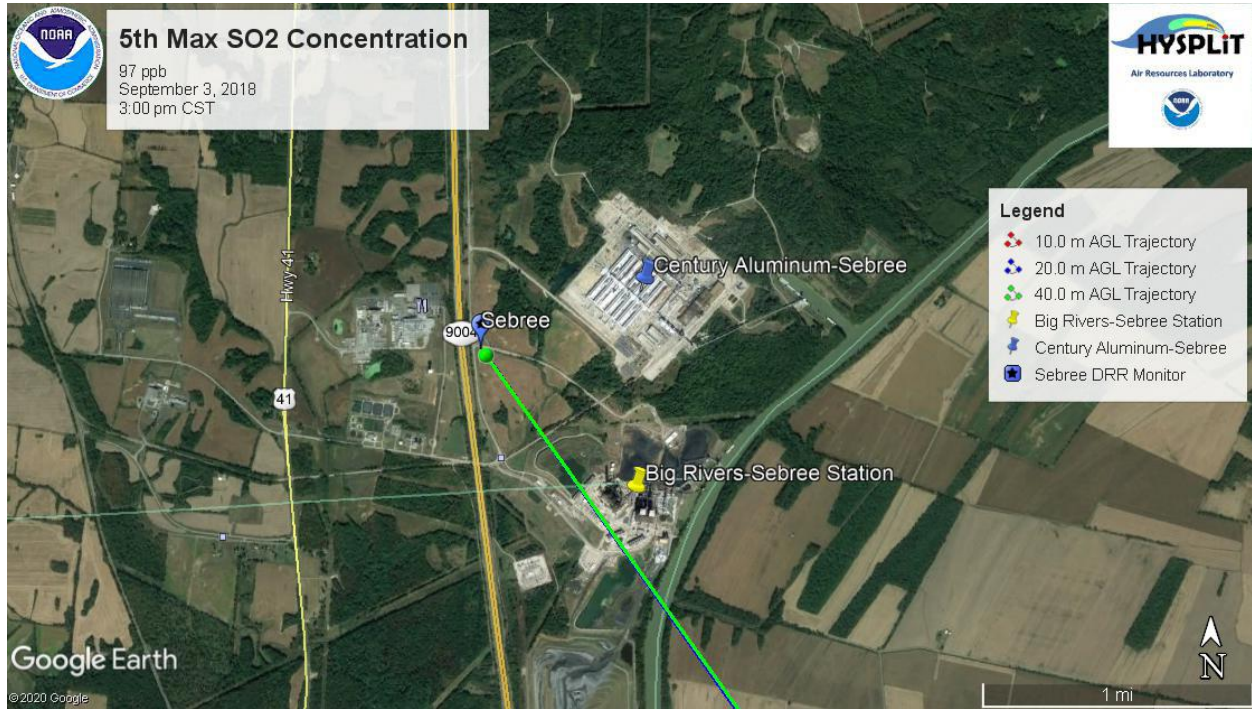
¹⁰ Page 10 of Kentucky's July 7, 2020, boundary recommendation letter.

Figure 5. 1st Max 2019 HYSPLIT for Henderson-Webster Kentucky



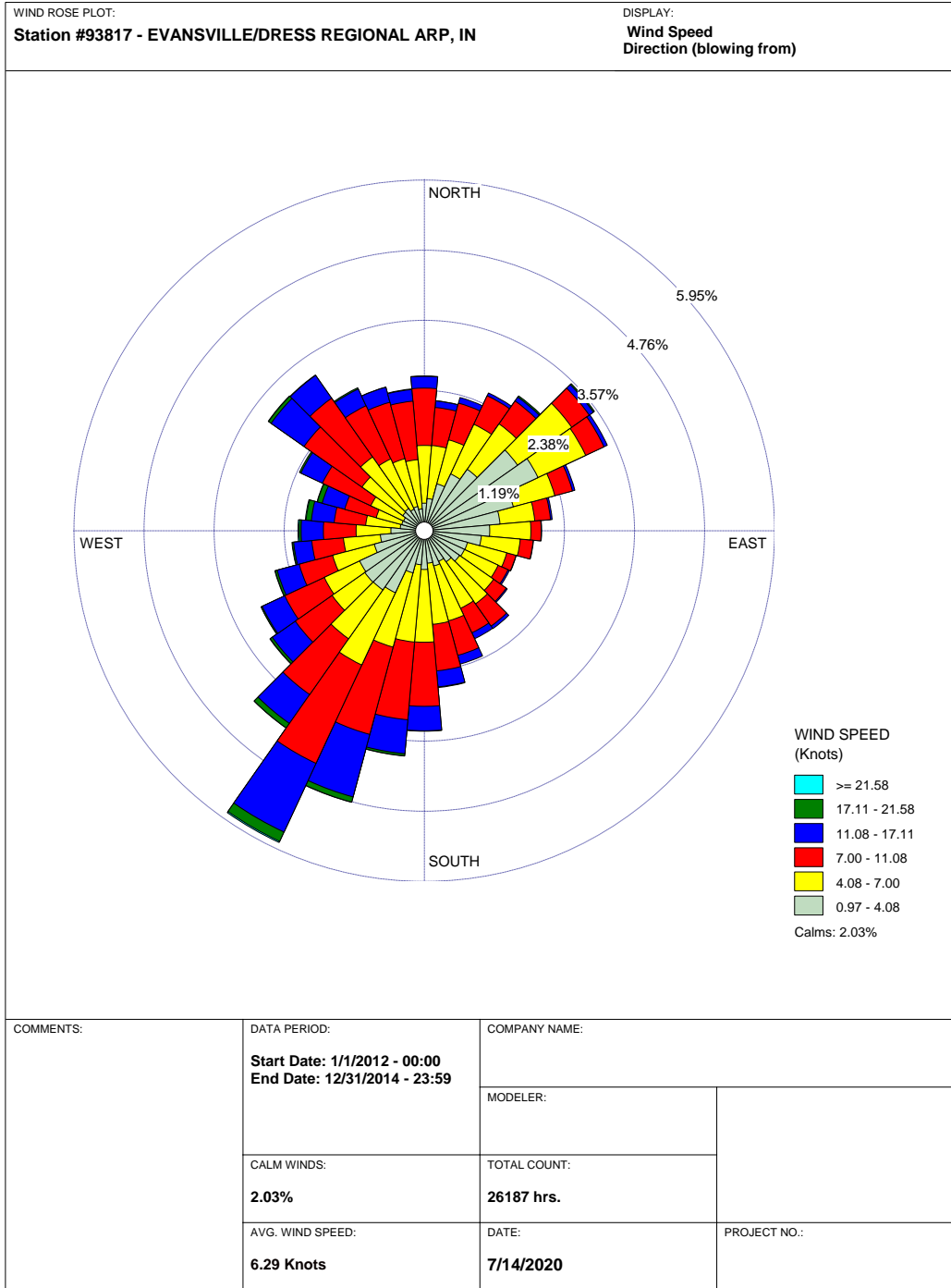
Appendix A of Kentucky’s submittal contains an additional fifteen HYSPLIT trajectories that evaluated all the hours the Sebree SO₂ DRR monitor recorded an exceedance of the 2010 1-hour SO₂ NAAQS. Kentucky’s submittal indicates that all but one exceedance shows the wind trajectories passing over the nearby Century Aluminum facility. Figure 6 below (Figure 2018-5 from Appendix A of Kentucky’s submittal) is the HYSPLIT trajectory that shows the winds passing over Big Rivers – Sebree Station. Kentucky indicates that in 2018, the HMP&L Station 2 portion of the BREC Reid/HMP&L Station 2 facility emitted higher SO₂ emissions than in 2019, which can be seen in Table 4 above, and that the facility is now retired. EPA acknowledges that HMP&L Station 2 SO₂ emissions have decreased from 848 tons per year (tpy) in 2018 to 20 tpy in 2019. However, the emissions from BREC Green Station were greater than 2,900 tpy in 2019, as shown in Table 3 above. EPA believes that the back trajectories in Figure 6, the large amount of emissions from BREC Green Station, and the fact that BREC Green Station is located approximately 1.25 km from the Sebree monitor, indicate that the facility is potentially contributing to the measured violations of the 2010 1-hour SO₂ NAAQS at the Sebree monitor.

Figure 6. 5th Max 2018 HYSPLIT for Henderson-Webster County. Source: Appendix A of Kentucky's July 7, 2020 Submittal



In addition to the HYSPLIT trajectories provided by Kentucky, EPA evaluated wind patterns in the area by creating a wind rose from meteorological records for the nearest National Weather Service (NWS) meteorological station at the Evansville Regional Airport in Evansville, Indiana. Figure 7 shows the Evansville 2012-2014 wind rose that was created using the AERMET-processed surface meteorology used in the AERMOD modeling performed to help site the Sebree Monitor, that is discussed in Section 3.3.1.b., of this TSD. Figure 7 indicates that winds blow from all directions, but most commonly from southwest, and, also from the northeast and northwest significant amounts of time. The highest frequency of slow wind speeds (1-4 knots) blow from the northeast, but also a significant amount of time from the southeast (the direction of the two BREC facilities). Typically, slower wind speeds result in higher ambient concentrations of sulfur dioxide from low-level stack releases, such as the emissions sources at Century Aluminum.

Figure 7. 2012-2014 Wind Rose for Evansville Regional Airport in Evansville, Indiana



3.3.4. Factor 4: Geography and Topography

Kentucky provided an analysis of the geography and topography of the Henderson-Webster, Kentucky Area. Kentucky examined the physical features of the land that may affect the distribution of emissions and may help define nonattainment area boundaries.

Kentucky determined that the topography and geography of the area surrounding the monitor do not impact the violations at the Sebree SO₂ DRR monitor as there are no significant changes in elevation between the DRR facilities mentioned in section 3.1 and the monitor.

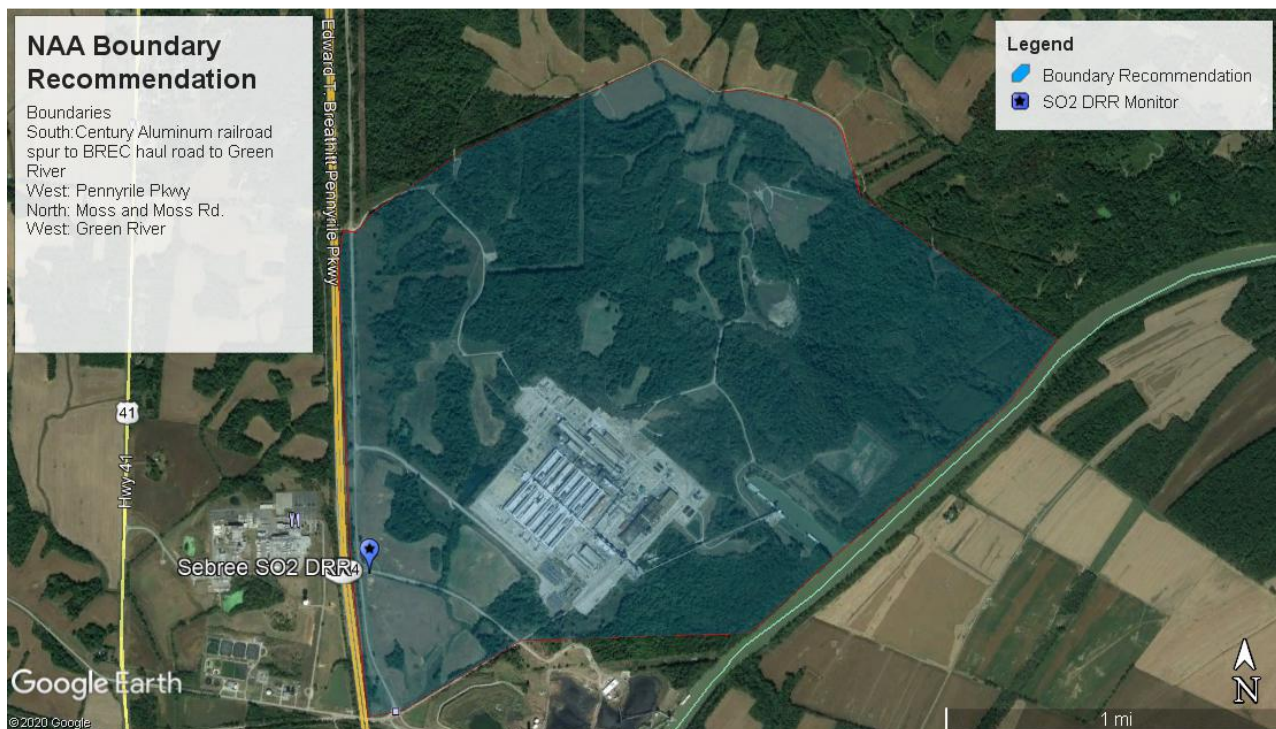
3.3.5. Factor 5: Jurisdictional Boundaries

Kentucky provided an analysis of the jurisdictional boundaries to establish the geographic extent of the violating area. EPA considers existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary for carrying out the air quality planning and enforcement functions for the area. Our goal is to base designations on clearly defined legal boundaries that align with existing administrative boundaries when reasonable. Existing jurisdictional boundaries used to define a nonattainment area must encompass the area that has been identified as meeting the nonattainment definition.

After analyzing the five factors outlined above, Kentucky recommended the nonattainment boundary illustrated in Figure 8, which the Commonwealth determined utilizes permanent and readily identifiable landmarks, and includes the violating monitor and Century Aluminum. The boundary is comprised of a US Highway to the west, a local road to the north, a river to the east/southeast, and a railroad spur to the south. The BREC facilities (BREC Reid/HMP&L Station 2 and BREC Green Station) are not included in the Kentucky boundary recommendation. Kentucky asserts that the HYSPLIT modeling demonstrates that the Century Aluminum facility is culpable for the monitored violations during 2017-2019. Additionally, the Commonwealth believes the SO₂ emissions from BREC, while not insignificant, are not a major contributor to the monitor violations due to the tall stacks, which allow for greater transport and dispersion, as opposed to the relatively low roof vents at the Century Aluminum. Kentucky's justification that tall stacks "allow for greater transport and dispersion" compared to Century Aluminum's "relatively low roof vents" is not conclusive enough to rule out contribution.

Based upon the information presented in this boundary recommendation, Kentucky recommends that all of Webster County, Kentucky be designated as attainment/unclassifiable with respect to the 2010 1-hour SO₂ NAAQS.

Figure 8. Kentucky Recommendation for the Henderson-Webster, Kentucky Area



3.4. Other Information Relevant to the Designation of the Henderson-Webster, Kentucky Area

EPA did not receive additional information relevant to the designation of this area.

3.5. EPA's Assessment of the Available Information for the Henderson-Webster, Kentucky Area

As mentioned above, the Sebree SO₂ DRR monitor in the Henderson-Webster, Kentucky Area is violating the NAAQS based on the 2017-2019 design value. EPA evaluated the five factors and all available information to determine the geographic extent of the violating area.

EPA's intended designation is based on all the information available.

Kentucky provided a discussion and figures of a dispersion modeling analysis performed to evaluate the SO₂ impacts from the BREC Green Station; however, the modeling files were not provided to EPA for review. Kentucky concluded from the dispersion modeling analysis that BREC Green Station is not causing a violation of the 2010 1-hour SO₂ NAAQS. Kentucky did not provide EPA sufficient information to agree with that conclusion, and EPA instead believes

the modeling results provided by Kentucky show that BREC Green Station is likely contributing to violations of the 2010 1-hour SO₂ NAAQS at the Sebree monitor in Henderson County.¹¹

In addition to the dispersion modeling analysis performed to evaluate the BREC Green Station, EPA reviewed modeling that Kentucky provided in 2016 which was conducted to support the location of the Sebree ambient air quality monitor in order to characterize all three DRR sources (rather than install and operate separate monitors for each source). As this modeling was not conducted for the purpose of air quality designations, EPA was unable to use this information specifically in determining the exact geographic extent of the 2010 SO₂ NAAQS violations that occurred during the 2017-2019 monitoring period; however, EPA determines that this modeling indicates the potential for elevated SO₂ concentrations extending well beyond the nonattainment boundary proposed by Kentucky, including a larger portion of Henderson County and a portion of Webster County.

Kentucky provided an analysis of the meteorology for the Henderson-Webster, Kentucky Area. EPA preliminarily agrees with Kentucky's conclusion that the HYSPLIT trajectories indicate that the Century Aluminum facility contributes to the monitored violation; however, EPA also believes that other back trajectories, the level of emissions from BREC Green Station, and the fact that it is located approximately 1.25 from the Sebree monitor, indicate that the facility is potentially contributing to the measured violations of the 2010 1-hour SO₂ NAAQS at the Sebree monitor. Additionally, EPA evaluated wind patterns in the area by creating a wind rose from meteorological records for the nearest NWS meteorological station at the Evansville Regional Airport in Evansville, Indiana. The wind rose indicates that winds blow from all directions, but most commonly from southwest, and, also from the northeast and northwest significant amounts of time. The highest frequency of slow wind speeds (1-4 knots) blow from the northeast, but also a significant amount of time from the southeast, which is the direction of the two BREC facilities.

As a result of evaluation of all the available information, including our qualitative assessment of the modeling conducted to support the location of the ambient air quality monitor, EPA is modifying Kentucky's recommendation for the nonattainment boundary for Henderson County, and is modifying the Commonwealth's designation and boundary determination for a portion of Webster County.

EPA believes that our intended nonattainment area, bounded by the portions of Henderson and Webster Counties contained within census block groups 211010209001, 211010208001, 211010208003, 212339601002, 212339601004, 212339601003, and 212339601001, will have a clearly defined legal boundary, and we intend to find this contiguous boundary to be a suitable basis for defining our intended nonattainment area. The magnitude of the monitoring concentrations coupled with the emissions from the SO₂ sources and the information available for Henderson and Webster Counties from the citing of the Sebree SO₂ DRR monitor warrant

¹¹ If Kentucky provided the missing supporting information related to the modeling and included SO₂ emissions from nearby sources that are potentially contributing to the violations at the Sebree monitor, EPA may be able to consider such information to demonstrate the geographic extent of the 2010 SO₂ NAAQS violations and refine the nonattainment boundary.

consideration of a bigger boundary than recommended by the Commonwealth absent additional technical support.

EPA intends to designate the remaining portions of Henderson and Webster Counties as attainment/unclassifiable due to a lack of SO₂ emissions sources or any other information that indicates those areas do not meet the 2010 1-hour SO₂ NAAQS.

Based on the factors discussed above, EPA believes that the remaining undesignated area neither has violations nor contains any sources that could contribute to air quality in an area that violates the NAAQS. Therefore, we intend to designate the remainder of Henderson and Webster Counties as attainment/unclassifiable.

3.6. Summary of EPA's Intended Designation for the Henderson-Webster, Kentucky Area

After careful evaluation of the Commonwealth's recommendation and supporting information, as well as all available relevant information, EPA intends to designate the Henderson-Webster, Kentucky Area as nonattainment for the 2010 1-hour SO₂ NAAQS. Specifically, the boundary is comprised of the portions of Henderson and Webster Counties contained within census block groups 211010209001, 211010208001, 211010208003, 212339601002, 212339601004, 212339601003, and 212339601001. Figure 9 shows the boundary of this intended designated area.

Additionally, EPA intends to designate the remainder of Henderson and Webster Counties as attainment/unclassifiable.

Figure 9. Boundary of the Henderson-Webster, Kentucky Intended Nonattainment Area and Intended Attainment/Unclassifiable Area

