Submitted for:
Sanders Lead Company, Inc.
Troy, AL

Submitted by:
AECOM
Franklin, TN

Sanders Lead Company, Inc.
Troy, Alabama
1-hour SO_2 Modeling Report – Analysis of Results

Original: January 19, 2017

Contents

1.0 Project Description

1.1 Purpose

Sanders Lead Company, Inc. (Sanders Lead) has retained AECOM Technical Services (AECOM) to prepare a modeling analysis for sulfur dioxide (SO_2) emissions releases from their facility located in Troy Alabama. The purpose of this document is to present to the Alabama Department of Environmental Management (ADEM) the modeling procedures used to conduct the air dispersion modeling analysis as well as the modeling results with respect to the 1-hour National Ambient Air Quality Standard (NAAQS) for SO_2 and the non-attainment demonstration.

A modeling protocol was prepared and submitted to the Alabama Department of Environmental Management (ADEM) in April 2016 (and revised May 2016) to provide a general overview of the modeling procedures proposed for this analysis. Following review of the modeling protocol by ADEM, the modeling protocol was submitted to Region 4 of the Environmental Protection Agency (EPA Region 4) for review and approval. EPA Region 4 made three (3) comments to ADEM which have been addressed in the applicable sections of this modeling report.

To the extent possible, the approved modeling procedures were consistent with applicable guidance, including the December 2013 "SO_2 NAAQS Designations Modeling Technical Assistance Document" (TAD) issued in draft form by the United States Environmental Protection Agency (USEPA). The modeling approach was consistent with the final Data Requirements Rule (DDR) for the 2010 1-hour SO_2 primary NAAQS.

The current version of the TAD references other USEPA modeling guidance documents, including the following clarification memos (1) the August 23, 2010 "*Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 NAAQS*" and (2) the March 1, 2011 "*Additional Clarification Regarding Application W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard*" (hereafter referred to as the "additional clarification memo"). In the March 1, 2011 clarification memo, USEPA declares that the memo applies equally to the 1-hour SO_2 NAAQS even though it was prepared primarily for the 1-hour NO_2 NAAQS.

1.2 Facility Description

Sanders Lead operate a Secondary Lead Smelting facility in Troy, Pike County; Troy is located 70 kilometers southeast of Montgomery, Alabama. The primary activities at Sanders Lead are Secondary Lead Smelting and Refining (Standard Industrial Classification [SIC] code 3341). Primary operations at Sanders Lead include three (3) major operations: scrap preparation, smelting, and refining; however, it should be noted that SO_2 is only emitted from the smelting operations.

1.2.1 Property Boundary

The property boundary (243 acres) is encircled by a chain link fence topped with three strands of barbed wire, per our TSD Part B Permit. In some areas, the fence is 8 feet high, in others, its 12 feet. The facility is routinely patrolled by the facility's security team (24 hours per day, 7 days per week) and the facility maintains security cameras at multiple key locations along the property boundary.

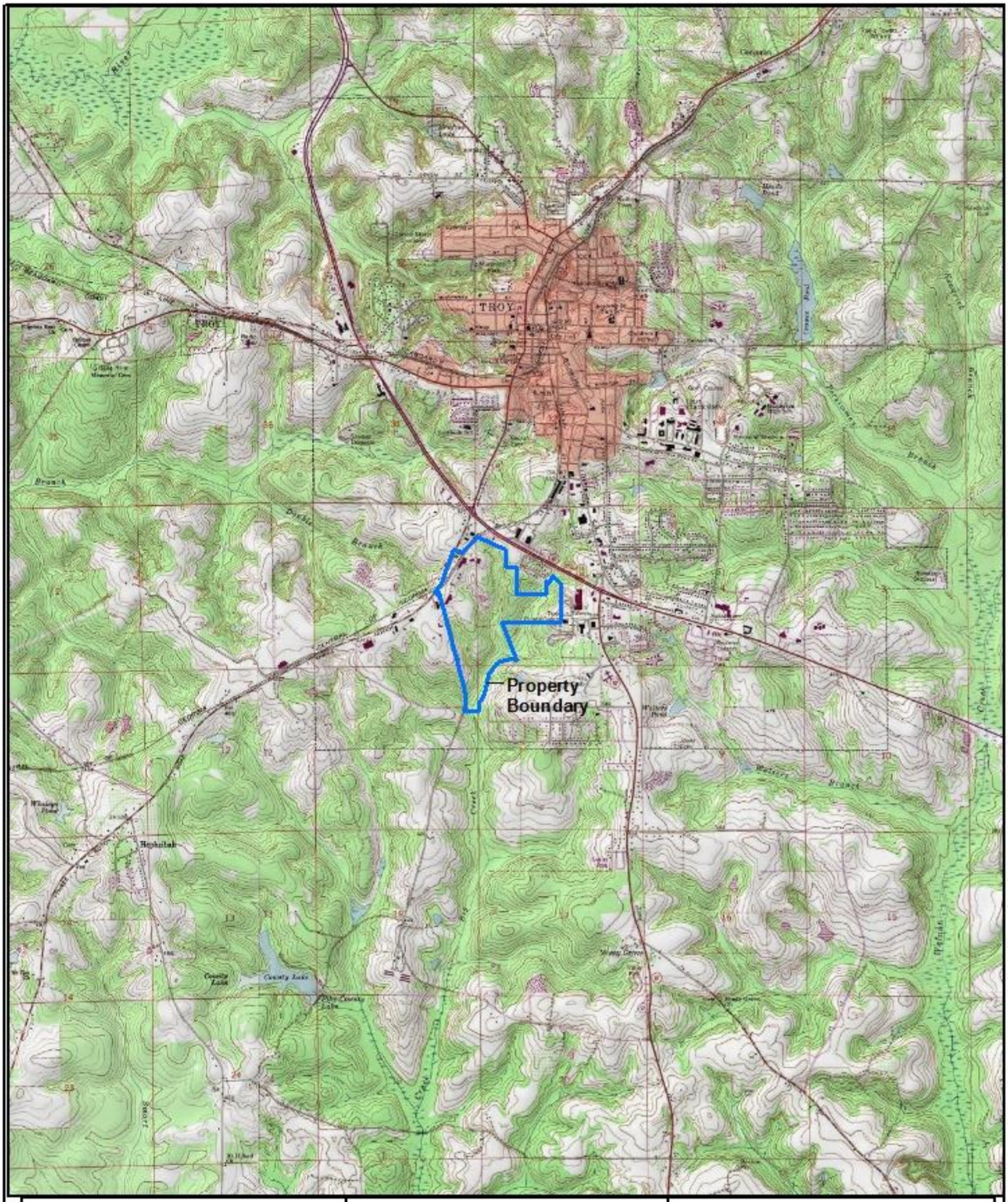
1.3 Location

Sanders Lead is located at 1 Sanders Road, in Troy, Alabama. As shown in **Figure 1-1**, Troy is located in southeastern Alabama, in Pike County. Troy is located 70 kilometers southeast of Montgomery, Alabama. Figure 1-1 displays the plant site on a 7.5 minute USGS map along with a depiction of current company owned plant boundaries. The city population of Troy is approximately 13,935. According to the United

States Census Bureau, the city has a total area of 26.3 square miles (68.2 km^2), of which, 26.2 square miles of it is land and 0.1 square miles of it (0.36%) is water.

1.3.1 Site Characteristics

As shown in **Figure 1-1**, Troy is located in a gently rolling area of Alabama with no local topographic features which appreciably influence weather and climate. During the months of June through September, inclusive, temperature and humidity conditions generally show little change from day to day. During the coldest months, December, January, and February, there are frequent shifts between mild and moist air from the Gulf of Mexico and dry, cool continental air. From late June through the first half of August, nearly all precipitation is from local, mostly afternoon, thunderstorms, and there are apt to be considerable differences in day-to-day amounts of rainfall in different parts of the Troy area. In late August and in September, summer conditions of temperature and humidity persist as air continues to drift in from the Gulf, but local thunderstorms become less frequent because of the shortening of the days and the decrease in heat received from the sun. As this late summer season progresses, the local climate gives way to thunderstorms which occur with cold fronts and occasional general rains associated with storms on the Gulf. All types and intensities of rain, except the local thunderstorms of summer, may occur at any time from December through March or early April. Floods in the rivers are correspondingly most frequent during this period. Most rain from late April through early June is in the form of showers or thunderstorms occurring in advance of approaching cool fronts, which become weaker and less frequent as summer approaches. It is during this spring season, and during the late summer and early autumn, that droughts sometimes occur. Snow in Troy is important only as a curiosity. Near the facility, terrain has gentle undulations.



Location of
Sanders Lead Company

FIGURE 1-1

AECOM

Map Source: Copyright © 2011 National Geographic Society, Troy, Alabama

0 0.3 0.6 1.2 Miles

N

2.0 Model Selection

The use of AERMOD (USEPA 2004a) (Version 15181) is proposed for this modeling study. AERMOD is the USEPA guideline model for short-range transport and has the ability to account for the source types and dispersion environment located at, and surrounding, the Sanders Lead facility. AERMOD is appropriate for use for many different types of dispersion environments including: sources subject to building downwash and sources located in flat or elevated terrain.

As described in Section 1.2 and shown in Section 4.2, the area surrounding Sanders Lead is characterized by gently rolling terrain with elevations changing up to several hundred feet within a few kilometers of the plant site.

Based on USEPA guidance provided in the TAD, the stack will be modeled with the actual physical stack height. In addition, the USEPA's Building Profile Input Program (BPIP-Version 04274) version that is appropriate for use with PRIME algorithms in AERMOD will be used to incorporate downwash effects in the model for all modeled point sources. The building dimensions of each structure will be input in BPIPPRM program to determine direction specific building data. PRIME addresses the entire structure of the wake, from the cavity immediately downwind of the building to the far wake.

3.0 Modeling Domain

3.1 Determination of Sources to Include

Sanders Lead is located in a relatively isolated area, whereby very few industrialized areas surround the facility. Per ADEMs review of the surrounding SO_2 sources, ADEM has concluded that there are no additional facilities that will be included into this area designation modeling.

3.2 Primary Source

The DRR characterizes a primary source as those sources which have over 2,000 TPY of SO_2 emissions based on the most recent year of emissions data. Sanders Lead was identified by ADEM as having actual SO_2 emissions for the most recent calendar year in excess of 2,000 TPY. Therefore, the attainment status of the surrounding area with respect to the 1-hour NAAQS for SO_2 must be made.

3.3 Nearby Sources

On August 31, 2016, ADEM received comments from EPA Region 4. One concern expressed by EPA Region 4:

Comment #5: T*he protocol does not address whether other nearby SO2 sources in the area will be included in the modeling. An assessment should be performed to determine if there are nearby sources which may significantly contribute to modeled concentrations near Sanders Lead. As indicated in comment 4, the decisions about background concentrations should be made in conjunction with the decisions about which sources to specifically include in the modeling. Section 8 of EPA Modeling TAD provides guidance on selecting appropriate background concentrations. There are no specific procedures that are applicable to every situation, so the guidance provides a number of options depending on the available data. EPA modeling staff are available to further discuss proposed background concentrations and how they may impact the selection of which other "nearby sources" to model. The TAD indicates that these issues call for professional judgment and recommends consultation with an EPA Regional Modeling Contact prior to the modeling being performed.*

ADEM evaluated sources within a 20 km area surrounding the facilities that elected to following the modeling pathway for compliance under the SO2 1 hour Data Requirements Rule. ADEM believes that this is a reasonable starting point for evaluation of sources and does not preclude sources from choosing alternate screening criteria that include/exclude sources. A spreadsheet provided each facility with the facility(ies) that met the 2014 actual emissions (in tpy) divided by the distance of greater than 20 within a maximum distance of 20 km. This did include small sources at very close distances. Again, the metric ADEM used to develop the preliminary additional source(s) to be evaluated for inclusion in the modeling for the DRR subject sources choosing to model is as follows:

ADEM Metric:

- Q/D > 20 within 20km
- First, ALL sources within 20km of each facility were pulled;
- Next, a Q/D value was developed for each facility on the list, where Q represents the 2014 actual SO2 tpy emissions totals, and D represents the distance between the two facilities;
- If the Q/D metric yielded a value of greater than 20, the facility was retained and additional QA/QC was performed on a unit by unit basis.

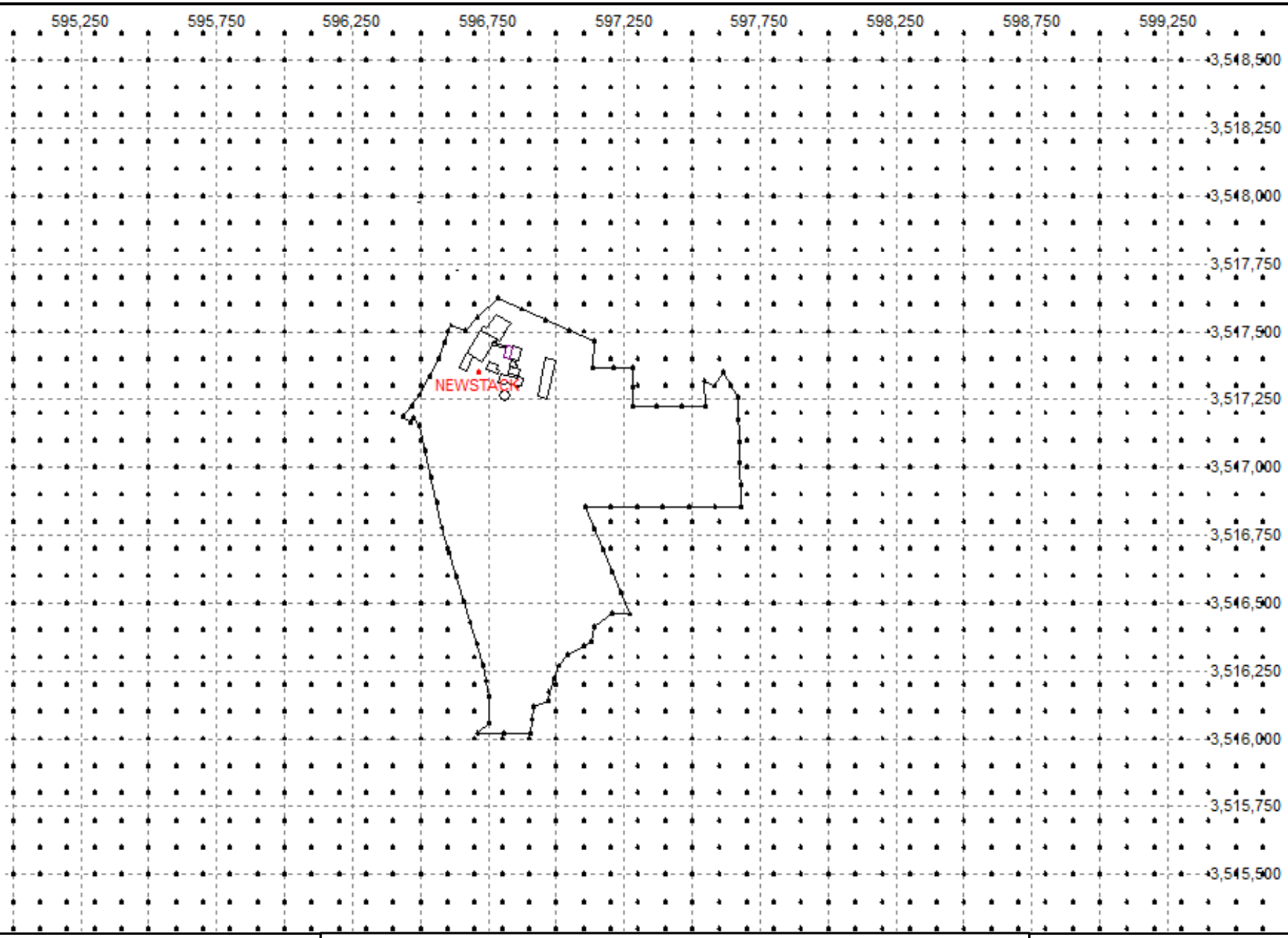
Results of this analysis showed that no additional sources meet these criteria; therefore, additional sources were not used in the modeling.

3.4 Receptor Grid

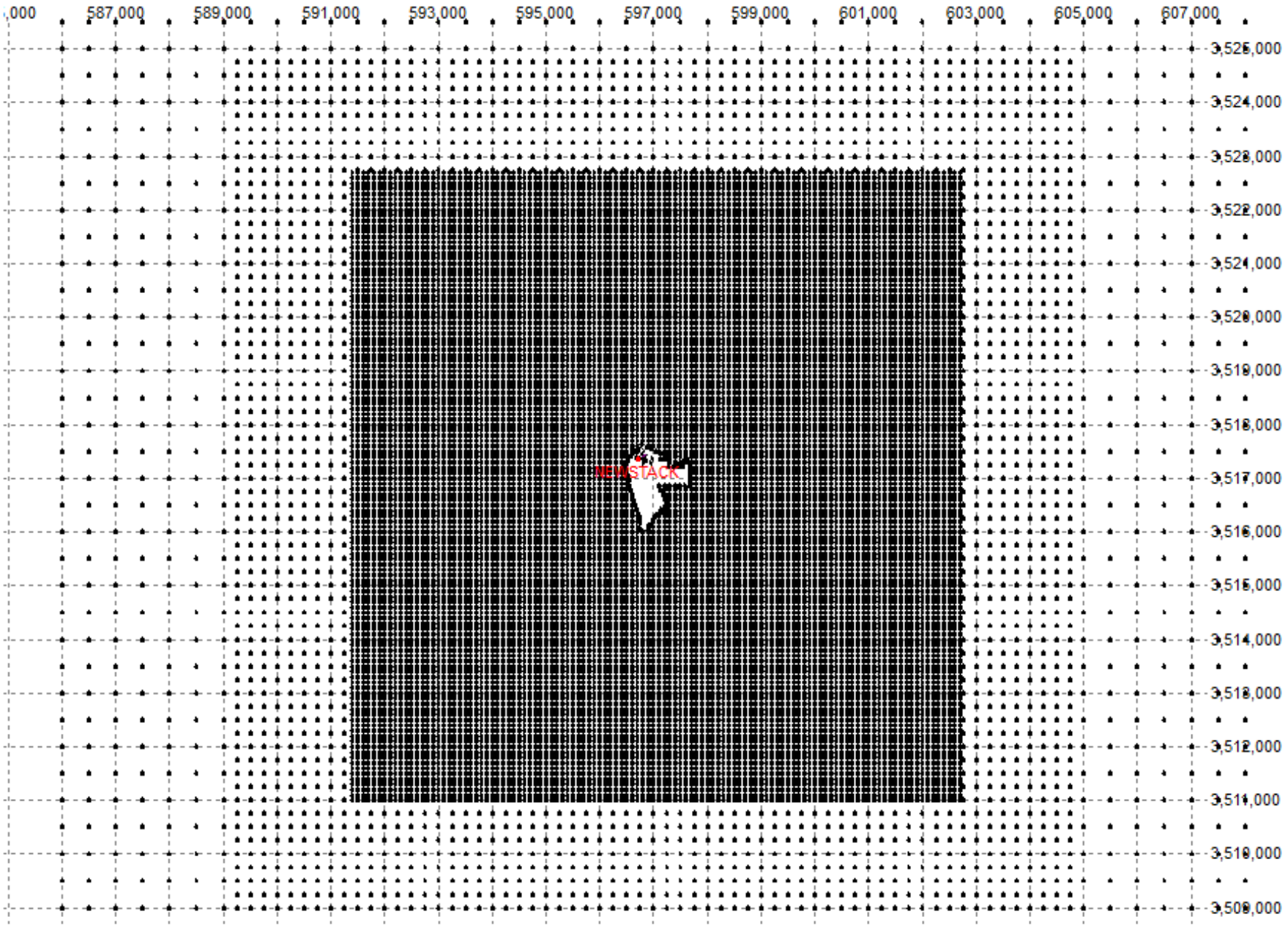
The proposed modeling analysis will be conducted using the following receptor grid design. A Cartesian receptor grid system will be created to adequately assess air quality impacts in all directions from the Sanders Lead fenceline to a distance of up to 10 kilometers from the site. The grid system will utilize the Universal Transverse Mercator (UTM) coordinate system. Discrete receptors will be placed along the property grid fenceline at 100 meter spacing. In addition, receptors extended outward from the fenceline at 100 meter grid spacing at 5,000 meter distance; 250 meter grid spacing at 7,000 meter distance and 500 meter grid spacing at 10,000 meter distance. It should be noted that if the predicted concentrations are not decreasing on the edge of the 10,000 m grid, then the grid distance will be extended further out. All receptors will include terrain heights generated from the AERMAP terrain processor, utilizing NED terrain data.

AERMAP (version 11103) (USEPA 2004c), the AERMOD terrain preprocessor program, will be used to calculate terrain elevations and critical hill heights for the modeled receptors using National Elevation Data (NED). The dataset will be downloaded from the USGS website (http://viewer.nationalmap.gov/viewer/) and will consist of 1 arc second (~30 m resolution) NED. The NED data used for this modeling exercise included the following quadrangles: Troy, Ansley, Banks, Brundidge, Brundidge NW, Goshen, Needmore, Saco and Youngblood.

Figures 3-1 and **3-2** show a graphical depiction of the near-field receptors and entire receptor grid proposed for modeling.



SANDERS LEAD COMPANY, INC.	Near-Field Receptors for AERMOD Modeling AECOM	FIGURE 3-1



SANDERS LEAD COMPANY, INC.	Entire Receptor Grid for AERMOD Modeling AECOM	FIGURE 3-2

4.0 Emission Rates and Source Characterization

4.1 Source Data

Currently Sanders Lead emits SO_2 through two (2) 180-foot stacks (No. 1 and No. 5) exhausting emissions from the baghouses controlling emissions from all four of the lead smelting blast furnaces, plus the occasionally used agglomeration furnace. There are no other sources of SO_2 emissions from the facility. The current allowable emissions for Stack No. 1 is 1,462 pounds per hour and allowable for Stack No. 5 is 1,253 pounds per hour. Based on screen modeling previously performed by Sanders Lead, as well as off-site SO_2 monitoring data being collected by the facility, Sanders Lead is assuming additional controls will be required in order to meet the new 1-hour SO_2 ambient air standard of 75 ppb. Therefore, Sanders Lead has committed to install, prior to the ambient SO_2 compliance deadline, a wet scrubber system that will have sufficient capacity to handle the flow from both of the existing stacks.

The new scrubber will be installed downstream of the existing baghouses and will employ ammonia injection as the reagent to reduce SO_2 emissions. The stack exit will be 180 feet above grade with an exit diameter of 8 feet, 11 inches. Based on engineering design, the unit will exhaust 160,000 acfm at a 115 ^{o}F. Therefore, as presented in the approved modeling protocol, modeling was performed to determine a proposed new allowable emission rate based on the new stack parameters. This report verifies that significant reductions in SO_2 emissions will be required. Based on the results of this modeling, the proposed allowable SO_2 emission limit would be 315 pounds per hour.

4.2 Urban vs. Rural Determination

The approximate UTM coordinates of Sanders Lead is NAD27 Zone 16, 596.744 km east and 3517.284 km north, at an elevation of approximately 160 meters above mean sea level. Based on area classification systems recognized by EPA, the facility is located in a rural section of the state. EPA guidance shows two alternative procedures to determine whether the character of an area is predominately urban or rural: (1) land use typing or (2) population density. The area classification system as described by Auer in the Journal of Applied Meteorology, Vol. 17, pg. 636-643, 1978, Correlation of Land Use and Cover with Meteorological Anomalies, is frequently used to classify the area.

The ADEM requires an Auer land use analysis which uses USGS maps to make a rural/urban determination. From this review it was apparent the area within a 3-km radius of the facility is rural using Auer techniques. To confirm this conclusion AECOM used AERSURFACE program to also confirm what the USGS maps indicated. That is the area surrounding the facility is largely rural in nature with greater than 50 percent of the area made up of trees and vegetation. For the landuse analysis, AECOM used a 3 km distance to evaluate surface roughness. AECOM understands that for developing surface boundary layer parameters for AERMET processing (stage 3) a one kilometer distance is required. Results using a one kilometer radius have been presented in a recent landuse protocol submittal to the ADEM. Results from the 3-km analysis indicate that urban dispersion adjustments based on population will not be needed for the SO_2 modeling submittal.

EPA modeling guidance provided in the AERMOD Implementation Guide and the Guidelines on Air Quality Models (Appendix W) indicate that a population density greater than 750 people per square kilometer determines whether the urban dispersion option is selected in AERMOD.

An initial population density value based on 2010 census data for Troy, Alabama obtained from http://en.wikipedia.org/wiki/Troy,_Alabama indicates a population density of 250 people/km^2. Since the EPA trigger of 750 people/km^2 value is not exceeded, urban AERMOD options will not be selected.

5.0 Meteorological Data

5.1 Overview

As provided by ADEM, meteorological data from National Weather Service (NWS) surface data from Evergreen, Alabama (ID# KGZH, Station ID: 53820) and upper-air data from Alabaster, Alabama (ID# KEET, Station ID: 53823) will be used for the SO2 modeling attainment demonstration. As recommended by ADEM, NWS 1-minute meteorological data from 2012 through 2014 shall be processed for this attainment demonstration.

This data has historically been used to characterize modeling for this facility for the past few years. There have not been any geographical changes in the area that would deem this NWS site unrepresentative. There are no other new datasets nearby that would better represent this location. NWS surface and upper air sites are limited in this area. Furthermore the data map below has been used to determine met data for PSD for decades. This data is typically determined on an application by application basis. Below is ADEMs section of the guidance document that addresses representativeness.

On August 31, 2016, ADEM received comments from EPA Region 4. One concern expressed by EPA Region 4:

Comment #3: *Section 5.1 of the protocol states that hourly surface meteorological data from Evergreen, Alabama will be used in the modeling analysis. Additional justification should be provided to demonstrate and document that surface meteorological data is representative of dispersion conditions at Sanders Lead. In addition, since the protocol proposes to use Alabaster, Shelby County (KEET) as its upper air meteorological data, the modeling report should provide a summary of missing 12Z upper air soundings for the record.*

Use the following Meteorological PSD Data Map (**Figure 5-1**) to identify the area of the State in which the proposed new source or modified source will be located to determine which National Weather Service (NWS) station data to use in the modeling. The station identification numbers are also indicated:

The map of Alabama modeling domains was broken out into 12 sections. These sections were determined by average monthly precipitation, average monthly mean temperature and topography. In each county, a COOP weather station was chosen and a 30 year (some stations less than 30) monthly average rainfall and monthly mean temperature was compared to the 12 surrounding NWS stations monthly data. The NWS station that correlated the closest to the COOP station was linked to that county. Once all the counties were looked at, they were grouped together by NWS station. The regions were adjusted to account for the various topographical differences across the state of Alabama.

Figure 5-1 Meteorological PSD Data

6.0 Background Monitoring Data

6.1 Overview

Ambient air quality data are used to represent the contribution of non-modeled sources to the total ambient air pollutant concentrations. In order to determine compliance with the 1-hour SO_2 NAAQS, the modeled design concentration must be added to a measured ambient background concentration to estimate the total design concentration. This total design concentration is then compared to the NAAQS to determine compliance.

An ambient background concentration for SO_2 will be added to the maximum predicted concentrations from the modeled source to determine a final maximum ambient concentration. ADEM provided AECOM with a representative background concentration, based on 2012-2014 data from the Centreville SO_2 monitor. The Centreville SO_2 monitor is a SEARCH monitor run by Alabama Power, and is located in a rural site in Centreville, AL which is in the middle of Bibb County. As illustrated in **Figure 6-1**, the Centreville SO_2 monitor is located approximately 100 miles northwest from Sanders Lead. Based on results from the Centreville SO_2 monitor, ADEM has determined that 44.0 µg/m3 provided a representative background concentration of SO_2 for the area.

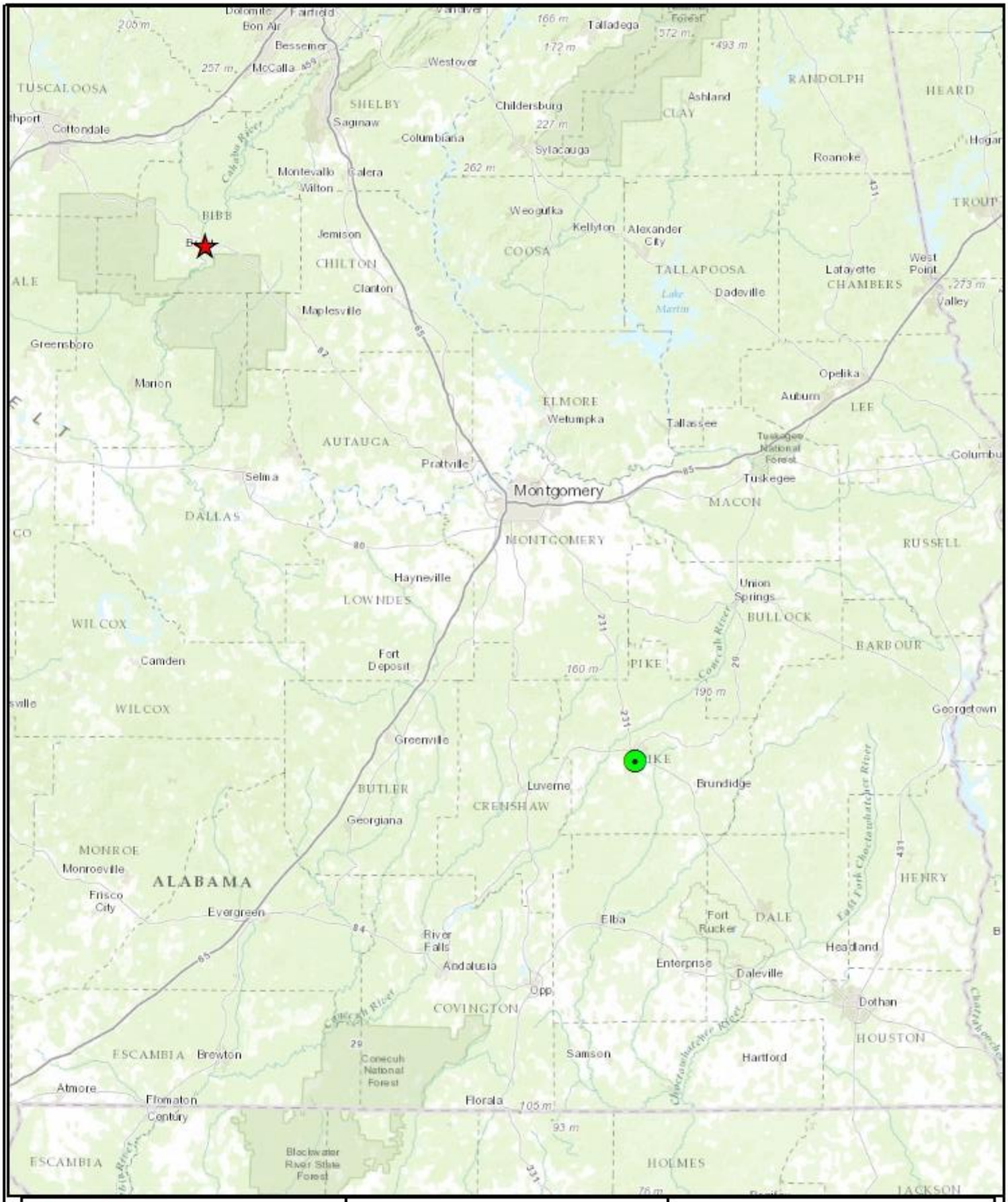
On August 31, 2016, ADEM received comments from EPA Region 4. One concern expressed by EPA Region 4:

Comment #4: T*he protocol states that the 2012-2014 hourly SO2 values from the Centreville monitor operated by Southern Company will be used to determine the representative background concentrations. This is not a regulatory monitor and therefore should not be used to develop background concentrations for this modeling demonstration. Please select an alternative monitor that meets Part 58 requirements and has complete data to use as a background site for this modeling demonstration. Section 8 of EPA Modeling TAD provides guidance on selecting appropriate background concentrations. There are no specific procedures that are applicable to every situation, so the guidance provides a number of options depending on the available data. EPA modeling staff are available to further discuss proposed background concentrations and how they may impact the selection of which other "nearby sources" to model. The TAD indicates that these issues call for professional judgment and recommends consultation with an EPA Regional Modeling Contact prior to the modeling being performed.*

The 1-hour SO2 background values used for this analysis were derived from data collected at the Centreville, Alabama, SEARCH site. The Centreville SEARCH site is considered to be representative of background SO2 concentrations based on a number of factors. The data from this SEARCH site has very little impact from anthropogenic sources, therefore, it should be representative of background 1-hour SO2 values for most areas of the State of Alabama. The purpose of adding the background value to the final model-predicted concentration is to account for the potential impact of sources outside the scope of the modeling analysis, such as natural and distant sources, which may minimally impact air quality in the area.

Other monitors located outside the State were considered as possible background sites, but due to the proximity of alternative monitors to urban areas and anthropogenic sources, these monitors would not provide an appropriate background concentration. Using concentrations from urbanized/industrialized areas can unduly influence the monitors and not provide a value that is truly representative of background conditions in a rural area. These areas tend to be more populated and urbanized, which is not representative of rural areas such as the Troy area. These monitors are likely impacted by urban influences and would not be representative of the rural background conditions in Troy, Alabama.

Additionally, due to the Centreville site's location relative to Troy, the synoptic-scale weather conditions in the Centreville area would be very similar to the Troy area. Most major weather systems that would impact the Troy area would, in general, impact the Centreville area as well. Due to all the factors cited above, ADEM determined that the Centreville, Alabama, site was the appropriate background monitor to use for this analysis.



Legend

- Sanders Lead Company
- Centreville SO2 Monitor

Location of Nearby Monitor in Relation to Sanders Lead

AECOM

FIGURE 6-1

0 5 10 20 Miles

N

7.0 Model Results

Modeling was performed using the steps and input data mentioned in the above sections. **Tables 7-1** provide a summary of the input parameters used for the modeling analysis. **Table 7-2** presents the 99th percentile daily maximum value over the three year period from 2012 through 2014; 2014 reported the highest daily maximum at 149 µg/m^3. This corresponds to the highest fourth-high value. This modeled concentration was then added to the background value from the Centreville monitor, and this total concentration was then compared to the NAAQS. As is shown in the table, the modeling does not show a violation of the NAAQS.

Table 7-1 Model Input Parameters

Easting m	Northing m	Base Elevation ft	Stack Height ft	Temp. F	Flow ACFM	Exit Velocity fps	Stack Diameter ft	SO2 lb/hr
596760.84	3517308.99	505.87	180	115	160,000	42.70	8.92	315

Table 7-2 SO_2 Modeling Results

99th Percentile Modeled SO_2	Background Concentration	Total Modeled Concentration	1-hour SO_2 NAAQS	Percent of the NAAQS
µg/m^3 (ppb)	µg/m^3 (ppb)	µg/m^3 (ppb)	µg/m^3(ppb)	(%)
149 (57)	44 (17)	193 (74)	196 (75)	98%

8.0 References

US EPA 2004a. User's Guide for the AMS/EPA Regulatory Model (AERMOD). EPA-454/B-03-001 (September 2004 – Addendum March 2011). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

US EPA 2004b. User's Guide for the AERMOD Meteorological Preprocessor (AERMET). (EPA-454/B-03-002, November 2004 – Addendum February 2011). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

US EPA 2004c. User's Guide for the AERMOD Terrain Preprocessor (AERMAP). (EPA-454/B-03-003, October 2004 – Addendum March 2011). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

US EPA 2008. AERSURFACE User's Guide. (EPA-454/B-08-001, January 2008). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

US EPA 2009. AERMOD Implementation Guide (Revised). US EPA, Research Triangle Park, NC. March 19, 2009.