Atmospheric Sciences

Exponent®

Modeling Report for Century Aluminum of South Carolina, Inc.

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Prepared for

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Acronyms and Abbreviations

AAQS	Ambient Air Quality Standards
AERMET	AERMOD Meteorological Preprocessor
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AFS	Air Facility System
AIG	AERMOD Implementation Guide
AMPD	Air Markets Program Database
ASOS	Automated Surface Observing System
AWOS	Automated Weather Observing System
BAQ	Bureau of Air Quality
Bldg	Building
BLP	Buoyant Line and Point Source Model
BPIP	Building Profile Input Program
BPIPPRIME	EPA Building Profile Input Program for PRIME
BTU	British Thermal Units
C	Celsius
CFR	Code of Federal Regulations
Century	Century Aluminum of South Carolina, Inc.
DAK Americas	DAK Americas LLC Cooper River Plant
DEM	Digital Elevation Model
DHEC	Department of Health and Environmental Control
DRR	Data Requirements Rule
EPA	United States Environmental Protection Agency
GEOTIFF	Geostationary Earth Orbit Tagged Image File Format
GEP	Good Engineering Practice
GIS	Geographic Information Service
g/s	grams per second
hp	horsepower
hr	hour
K	Kelvin
Kapstone	Kapstone Charleston Kraft LLC (North Charleston)
KCHS	Charleston International Airport
KDYB	Summerville Airport
kg	kilograms
KJZI	Johns Island Airport, also known as Charleston Executive Airport
KLRO	Mount Pleasant Airport
KMKS	Moncks Corner, also known as Berkeley County Airport
km	kilometer
kW	kilowatt
lb/hr	pounds per hour
LLC	limited liability company
m	meter
m/s	meters per second

µg	microgram
$\mu g/m^3$	micrograms per cubic meter
MRLC	Multi-Resolution Land Characteristics
NAAQS	National Ambient Air Quality Standards
NAD	North American Datum
NED	National Elevation Dataset
NEI	National Emission Inventory
NLCD92	USGS National Land Cover Data 1992
NO_2	nitrogen dioxide
NWS	National Weather Service
ppb	parts per billion
PRIME	Plume Rise Model Enhancements
s	second
Santee Cooper Cross	Santee Cooper Cross Generating Station
SCE&G Williams	South Carolina Electric & Gas Williams Station
Showa Denko	Showa Denko Carbon Inc.
SIL	Significant Impact Level
SO_2	sulfur dioxide
TAD	*SO_2 NAAQS Designations Modeling Technical Assistance Document*
TPY	tons per year
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
z_o	surface roughness length

Limitations

This report summarizes work performed to date and presents the findings resulting from that work. The findings presented herein are made to a reasonable degree of scientific certainty. Exponent reserves the right to supplement this report and to expand or modify opinions based on review of additional material as it becomes available through any additional work or review of additional work performed by others.

1 Project Description

1.1 Purpose

This air quality modeling report, submitted to the South Carolina Department of Health & Environmental Control (DHEC) Bureau of Air Quality (BAQ), provides the procedures and results of a computer dispersion modeling demonstration for use in establishing the area attainment designation for the region surrounding Goose Creek, South Carolina with respect to the 1-hour National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO_2). The dispersion modeling effort focuses on the area surrounding the Century Aluminum of South Carolina, Inc. (Century) facility located in Goose Creek, in Berkeley County, South Carolina.

The procedures were designed to be consistent with applicable guidance, including the August 2016 "SO_2 NAAQS Designations Modeling Technical Assistance Document" (TAD) issued in draft form by the United States Environmental Protection Agency (EPA). The procedures were also designed to be consistent with the final Data Requirements Rule (DRR) for the 2010 1-hour SO_2 primary NAAQS. This rule was published in the Federal Register on August 21, 2015[1] and is now codified as 40 CFR 51 Subpart BB.

The current version of the TAD references other EPA modeling guidance documents, including the following clarification memos:

- The August 23, 2010 "*Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard*".

- The March 1, 2011 "*Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard*" (hereafter referred to as the "additional clarification memo").

[1] 80 FR 51051

Although the March 1, 2011 additional clarification memo was written primarily for the 1-hour nitrogen dioxide (NO_2) NAAQS, some of the guidance provided therein applies to the 1-hour SO_2 NAAQS after the differences in the form of the standards are taken into account. The modeling procedures also account for guidance provided by modeling staff at DHEC BAQ.

1.2 Century Facility Description

Century owns and operates an aluminum smelter located in Goose Creek, Berkeley County, South Carolina. The plant opened in 1980 and currently operates under the terms and conditions of Part 70 Air Quality Permit TV-0420-0015 issued by DHEC BAQ.

Century is a primary aluminum reduction facility that produces high-grade aluminum from the raw material aluminum oxide (alumina) using the Hall-Heroult electrolytic process. The aluminum manufacturing process at the facility consists of three basic steps: 1) the manufacture of carbon anodes from coke and pitch, 2) the reduction of alumina to produce molten aluminum, and 3) the processing of molten aluminum for end users. These three steps are divided into the following seven processes that emit regulated pollutants:

- Green Carbon Plant,
- Baked Carbon Plant,
- Anode Rodding,
- Potlines,
- Pot Repair,
- Cast House, and
- General Facility.

Only some emission units at Century emit SO_2. Attachment A to the Part 70 Air Quality Permit lists SO_2 emission rates that have previously been modeled for demonstrating compliance with DHEC Standard 2 ambient air quality standards. The stacks that were modeled for SO_2 are:

- Green Carbon Plant: Stacks 83, 84, and 85,
- Baked Carbon Plant: Stack 01,

- Potlines: Stacks 02, 03, 04, and 05, and
- Cast House: Stacks 51-103, 51-104, 51-105, 51-106, 51-107, 51-109, 51-110, 51-111, 51-112, 52-1, 52-2, 52-3, 64, and 122.

Note that there are currently no SO_2 emissions from Anode Rodding or from Pot Repair.

It should be noted that the "General Facility" process group includes a number of small, intermittent SO_2 emission sources such as emergency generators, emergency fire water pump, gas-fired space heaters, gas-fired steam cleaners, portable light stands, etc.

Consistent with guidance provided in the March 1, 2011 additional clarification memo, intermittent emissions sources were not included in the modeling because they do not operate continuously or frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour SO_2 concentrations. Similarly, the other insignificant sources at Century were not modeled, since their SO_2 emissions are small and not expected to interfere with attainment or maintenance of the 1-hour NAAQS for SO_2. Table 1 lists the intermittent and insignificant SO_2 sources at Century that were not included in the modeling.

Table 1 Century Intermittent and Insignificant SO_2 Sources

Unit ID	Description	Fuel	Other Information
IA-73026	5 Pit Filter Preheaters	Natural Gas	Very small units (0.5 Million BTU/hr each) to preheat filters in casting pits
IA-60028	Space Heaters	Natural Gas	Very small units used for comfort heat only
IA-04005	3 Steam Cleaners	Natural Gas	Very small units (0.45 Million BTU/hr each) used for maintenance activities
IA-40370	Emergency Fire Pump	Diesel Fuel	255 hp; provides firefighting water for emergency situations; operates less than 25 hours per year for testing and maintenance purposes
IA-81807/81809/N/A	Anode Preheater/Cathode Bar Heater/Cast Iron Pouring Ladle Heater	Natural Gas	Very small units (0.7, 0.8, and 1.5 Million BTU/hr) used to preheat/heat/evaporate moisture
IA-N/A	Portable Light Stands	Diesel Fuel or Gasoline	Small portable units used to provide emergency lighting
IA-N/A	Mobile Mixer	Gasoline	Small portable 11 hp mixing unit
IA-19040	Emergency Generator #1	Diesel Fuel	500 kW; provides emergency backup power to critical plant operations during rare extended power outages; operates less than 25 hours per year for testing and maintenance purposes
IA-N/A	Small Portable Generators	Gasoline	Very small portable units to provide emergency power for critical maintenance activities during an extended power outage
IA-N/A	5 Portable Crucible Heaters	Natural Gas	Small mobile 4.4 Million BTU/hr heaters used for crucibles moving from Potlines to Cast House
IA-GEN-19050	Bldg 138 Lift Station Emergency Generator	Diesel Fuel	50.7 kW; provides emergency backup power to lift station to prevent backup/spills of sanitary wastewater in the event of an extended power outage; operates less than 25 hours per year for testing and maintenance purposes

1.3 Location

Century is located in Goose Creek in Berkeley County, South Carolina. The facility is approximately 6 kilometers (km) north-northwest of the intersection of Highways 52 and 176 and about 2 km north of Old Mt. Holly Road.

The facility is located in an area characterized by woods and fields with no significant nearby terrain features. More than half of the area within 3 km consists of woody wetlands and evergreen forests. The nearest residences are over 2 km away. The facility is located approximately 40 km northwest (inland) of the nearest coastal area.

Figure 1 shows the terrain in the area surrounding the facility. Figure 2 shows the land use in the area. Figure 3 shows the area surrounding Century. A circle with a radius of 10 km centered on the facility is plotted to help establish scale on Figure 2 and Figure 3. Note that the circles plotted on some of the figures in this protocol are terrain following, so that the plotted circles may appear to have ripples.

Figure 4 shows a view of the area surrounding Century and includes a circle with a radius of 1 km centered on the facility to establish scale. Figure 5 shows a close up view of the Century facility.

Figure 1 Terrain surrounding Century

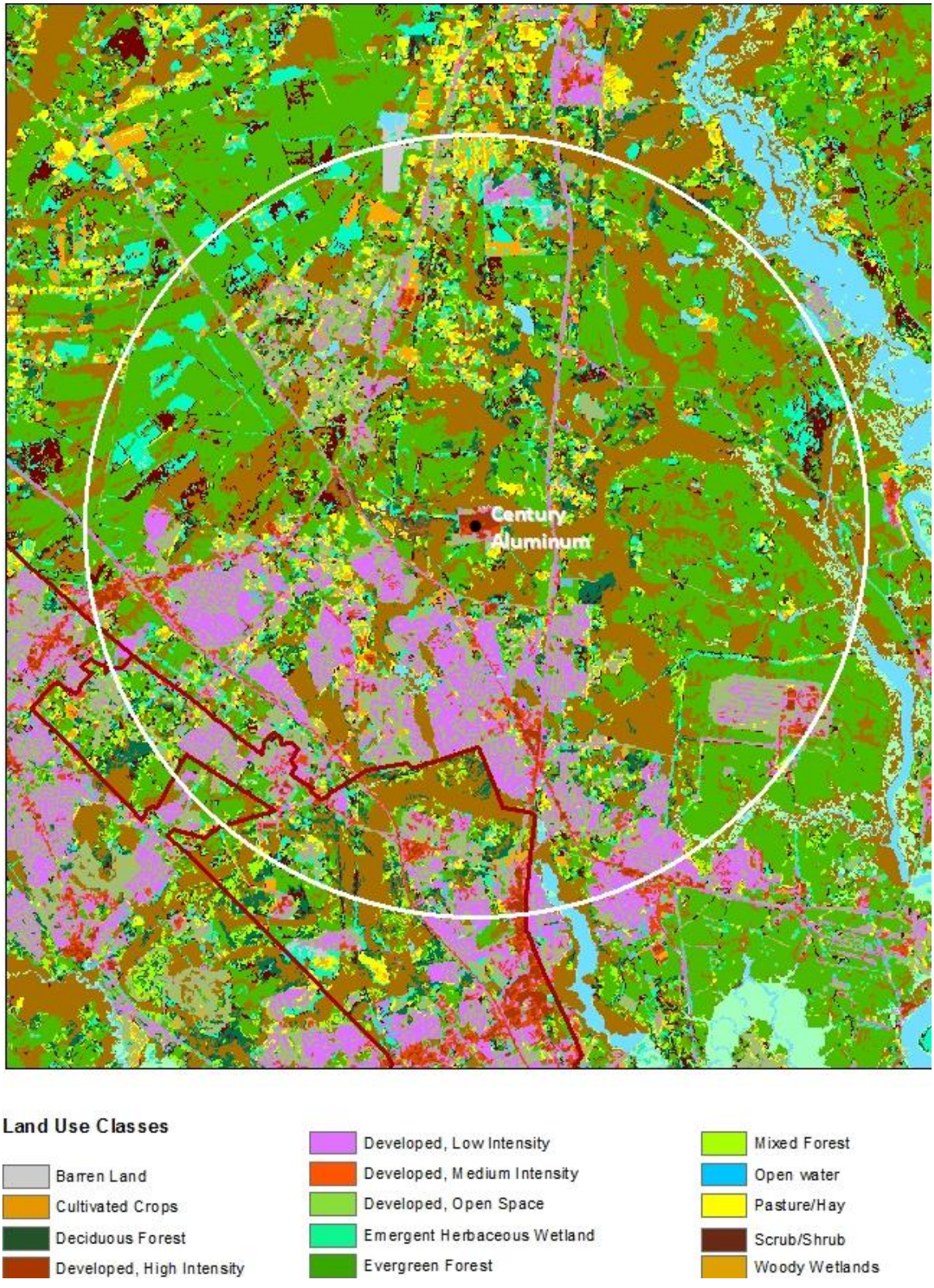

Figure 2 Land use surrounding Century with 10 km radius circle

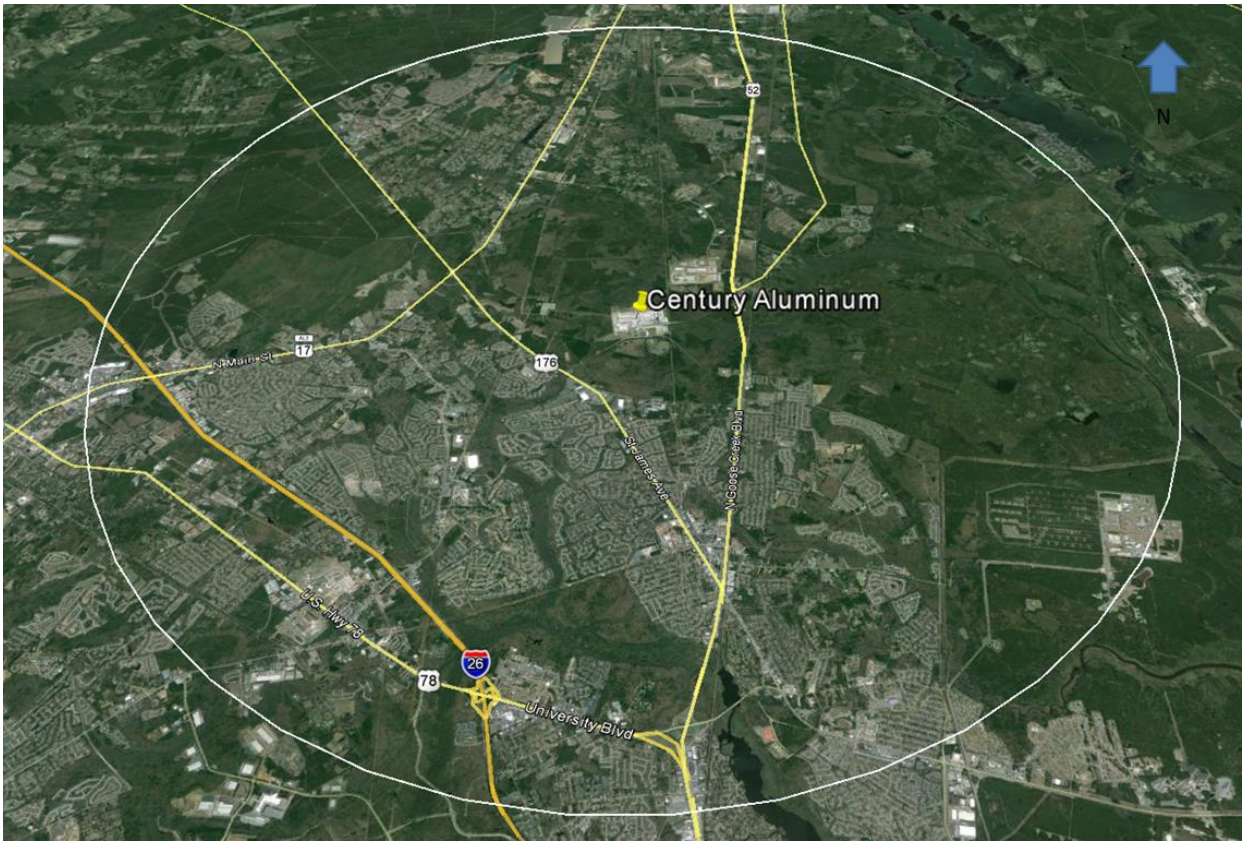

Figure 3 Area surrounding Century with 10 km radius circle

Figure 4 Area surrounding Century with 1 km radius circle

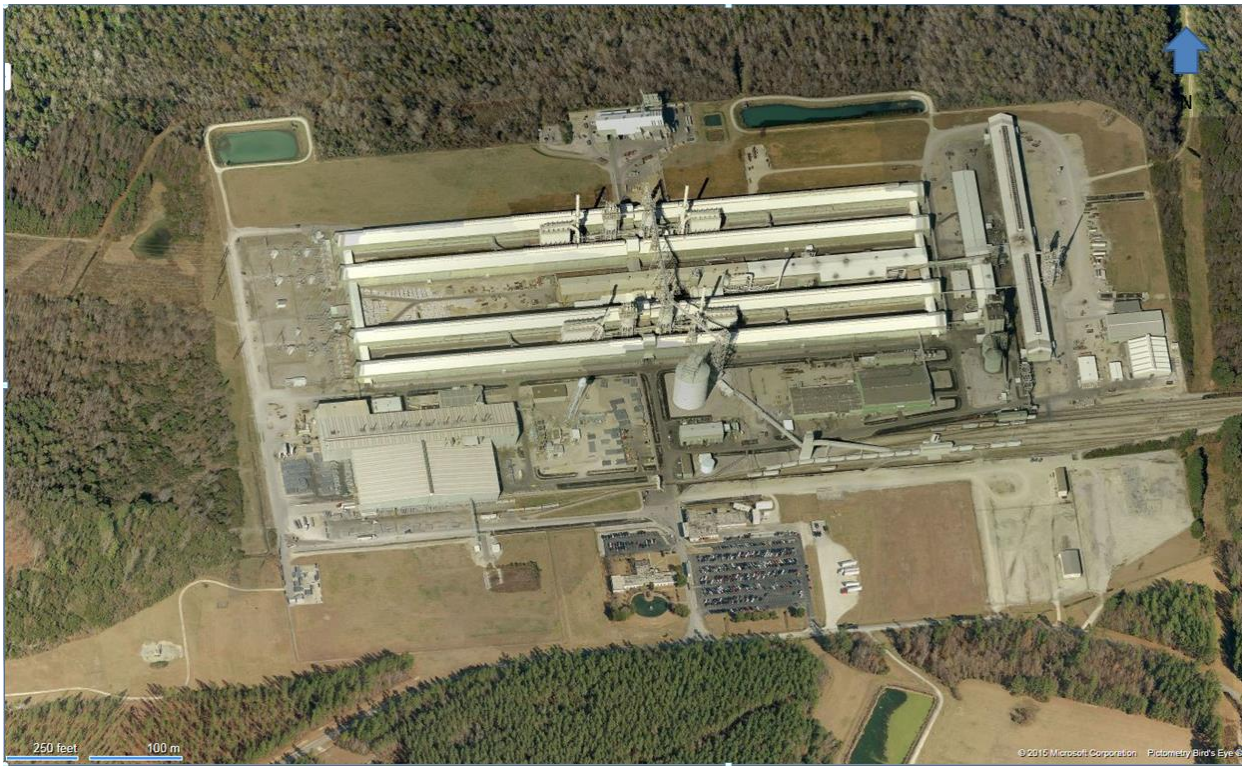

Figure 5 Close-up view of Century

1.4 Nearby Facilities

The EPA EnviroMapper[2] web interface was used to help identify stationary sources of air emissions located near Century. EnviroMapper is linked to EPA's Air Facility System (AFS), which contains emissions and compliance information on stationary air pollution point sources regulated by EPA, state, and local air regulatory agencies. Searches were conducted to identify point sources located within 5 km of Century.

The following nearby facilities were identified:

- Wando Redimix LLC, a ready-mixed concrete manufacturer,
- Magurd Enterprises LLC, a data processing service,
- Argos Ready Mix Monks Corner Concrete Plant, a ready-mixed concrete manufacturer,
- JW Aluminum Co., an aluminum sheet, plate and foil manufacturer, and
- McAlister-Smith Funeral Home, which operates a funeral home and crematory.

Figure 6 shows the approximate location (based on coordinates in AFS) of these nearby facilities relative to Century. Circles with radii of 1 km and 3 km surrounding Century are also plotted to help establish scale. Although these nearby facilities appear in AFS, they are not listed in DHEC BAQ annual summaries of stationary source SO_2 emissions.

Information provided by DHEC BAQ indicates that the first three facilities listed above (Wando Redimix LLC, Magurd Enterprises LLC, and Argos Ready Mix Monks Corner Concrete Plant) do not have any permitted sources of SO_2 emissions. These three sources were eliminated from further consideration, because they would not contribute to ambient SO_2 concentrations.

JW Aluminum Co. has a Title V permit and reports annual emissions to DHEC BAQ. McAlister-Smith Funeral Home has a registration permit for crematory operations and does not

[2] http://www.epa.gov/emefdata/em4ef.home

report air emissions to DHEC BAQ. The current registration permit for McAlister-Smith Funeral Home contains no explicit SO_2 emissions limits, but a modeling inventory provided by DHEC BAQ for sources in Berkeley County shows total facility allowable SO_2 emissions equal to 0.19 lb/hr. Continuous operation at this rate would yield total potential annual emissions of 0.83 tons per year (TPY) for SO_2.

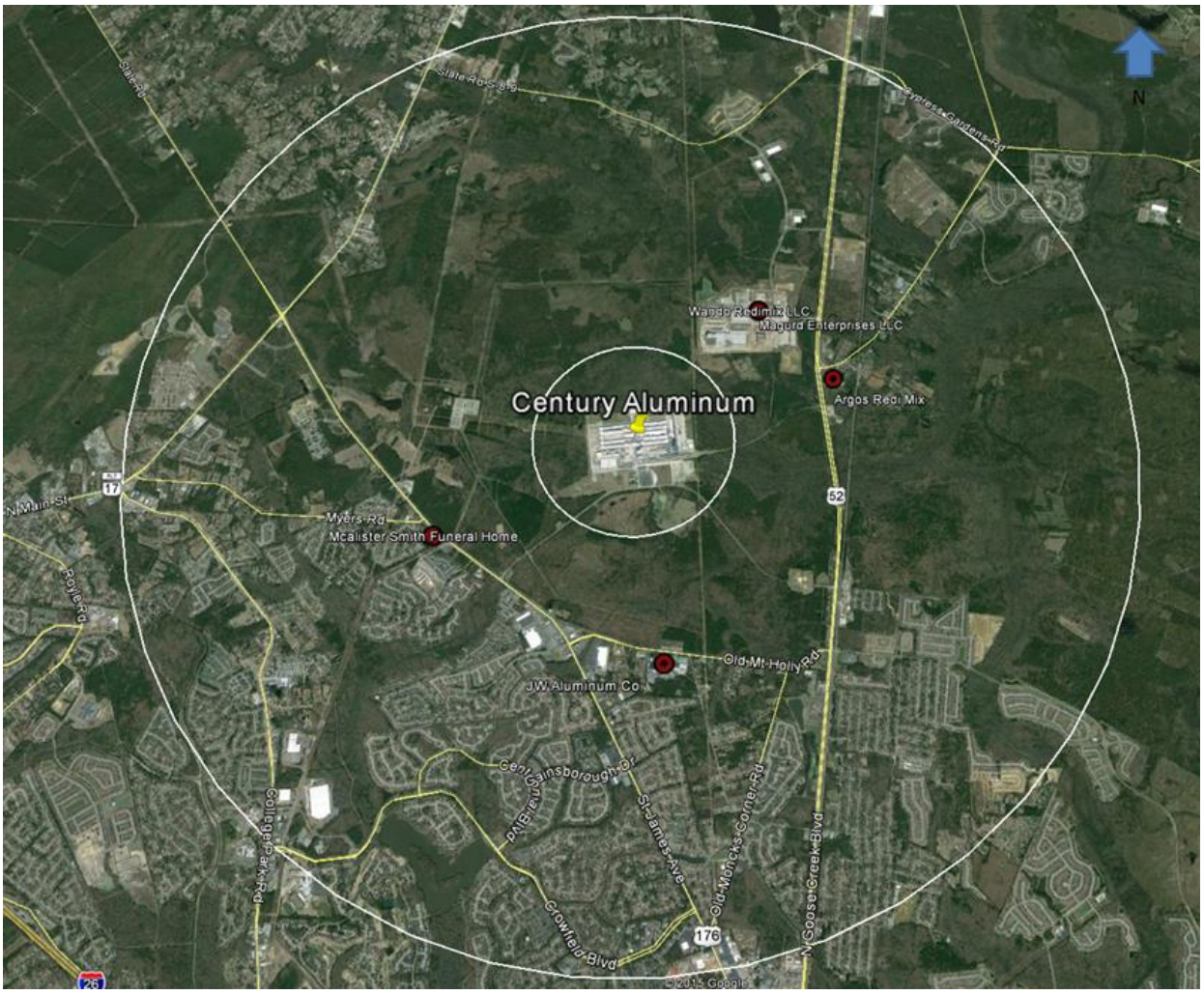

Figure 6 Nearby facilities to Century with 1 km and 5 km radius circles

2 Model Selection

The most recent version of the EPA AERMOD model (Version 15181) was used for the cumulative impact analysis for determining the appropriate attainment designation of the area surrounding Century with respect to the 1-hour NAAQS for SO_2. AERMOD is recommended in the EPA *"Guideline on Air Quality Models*" for a wide range of near-field applications in all types of terrain. In addition, AERMOD contains the PRIME building downwash algorithm, which accounts for aerodynamic building downwash effects. AERMOD was run with current regulatory default options to model all sources with buoyant line sources modeled using the new source type BUOYLINE.

The air quality dispersion modeling analyses account for potential aerodynamic building downwash effects for all modeled stacks at Century. Building parameters needed by AERMOD to model potential building downwash effects were obtained using the latest version (04274) of the EPA Building Profile Input Program for PRIME (BPIPPRIME).

3 Modeling Domain

3.1 Determination of Sources to Include

3.1.1 Primary Sources

The modeling domain for the SO_2 attainment area designation modeling analysis focuses on the primary facility that is the main subject of this modeling analysis, namely Century. Under the DRR, a source subject to its requirements (i.e., an "applicable source") is one with actual SO_2 emissions of 2,000 tons per year (TPY) or more or otherwise identified by an air agency as requiring air quality characterization.[3] Century was identified by DHEC BAQ as having actual SO_2 emissions in excess of 2,000 TPY for the most recent calendar year and thus is large enough to require modeling or monitoring to help establish the attainment status of the surrounding area with respect to the 1-hour NAAQS for SO_2.

3.1.2 Nearby Sources

The procedures used in identifying secondary facilities to include explicitly in the dispersion modeling analysis are described below, along with sources excluded from the area designation modeling. The sources considered include the two identified in Section 1.4 that were located within 5 km of Century and had permitted sources of SO_2 emissions (JW Aluminum and McAlister-Smith Funeral Home) as well as other, more distant sources.

Current modeling guidance in the TAD states that the process of determining which nearby sources to include in the attainment designation modeling should make use of professional

[3] In this report, the term "principal source" is used in place of "applicable source" to provide further clarity in distinguishing the applicable sources to the additional sources ("nearby" or "background" sources) that were considered for inclusion in the cumulative impact analysis.

judgment. Guidance in the TAD and in the referenced clarification memos state that the "*number of sources to explicitly model should generally be small*." [4]

The applicable guidance in the TAD and clarification memos also mentions that any nearby sources that are expected to cause a significant concentration gradient in the vicinity of the primary source being modeled should be included in the area designation modeling and that the impacts of any other sources should be incorporated via a consideration of background air quality concentrations.

Although some regulatory agencies have informally established minimum source emission rate thresholds below which nearby sources do not need to be explicitly included in the area designation modeling, neither EPA nor DHEC BAQ has yet done so. Consequently, a variety of considerations and technical justifications were used to select the background sources included in the cumulative impact analysis.

3.1.3 Screening Area

A screening area extending 50 km from Century was used to identify other potential nearby sources for inclusion in the analysis. Sources beyond 50 km are very unlikely to cause or contribute to a violation of the NAAQS in the vicinity of Century or to cause a significant concentration gradient in its vicinity.

3.1.4 Screening Procedures – Initial Consideration of Emissions and Proximity

Actual emission rates (when available) and proximity to the primary source are factors that were considered for including or excluding potential nearby sources within the screening area. Actual emission rates are appropriate for use in determining sources to include or exclude because of the focus of the area designation modeling, i.e., on estimating concentrations that would be actually measured at ambient air quality monitors.

[4] See Section 4.1, page 7 of TAD.

Proximity to Century is also a factor that was considered for several reasons. First, the farther away a candidate source is from Century, the less likely it is that the candidate source would have a significant contribution to a predicted violation of the NAAQS due to Century (or that Century would have a significant contribution to predicted violations caused by the candidate source). In addition, in the additional clarification memo, EPA references a general "rule of thumb" that the distance to a maximum 1-hour predicted impact and the region of significant concentration gradients in flat terrain is typically on the order of 10 times the stack height. Finally, EPA states that the process of identifying nearby sources to include in a cumulative impact analysis "*should focus on the area within about 10 kilometers of the project location in most cases*" and that the "*routine inclusion of all sources within 50 kilometers…is likely to produce an overly conservative result in most cases.*"[5]

DHEC BAQ provided county-by-county spreadsheets listing current allowable annual emissions for all facilities with air permits. Initial screening was conducted using these data to ensure that all facilities with current air permits would be considered. These data were first processed to identify all permitted facilities within the 50 km screening area. Figure 7 shows the location of all permitted facilities within 50 km of Century. Different symbols are used to indicate the relative magnitude of SO_2 emissions based on actual annual emission rates from 2014, when available, or otherwise based on allowable annual SO_2 emissions. Facilities with emission rates equal to or greater than 500 TPY are explicitly labeled by name. Figure 8 shows all permitted facilities within 20 km of Century.

[5] http://www.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_Final_03-01-2011.pdf p.16

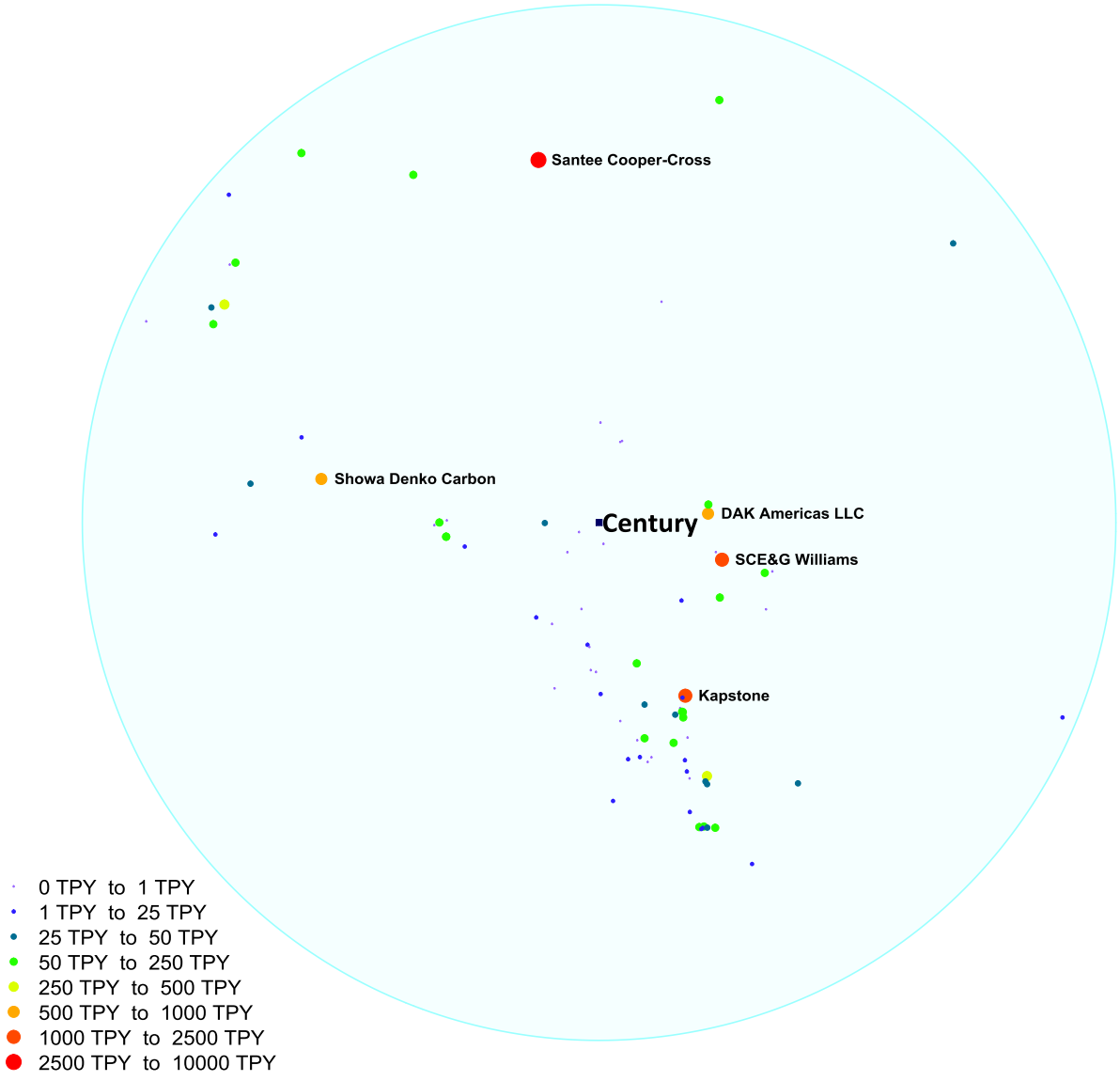

Figure 7 Annual SO_2 emissions (2014 actual emissions, when available, or allowable emissions) for permitted facilities within the 50 km screening area

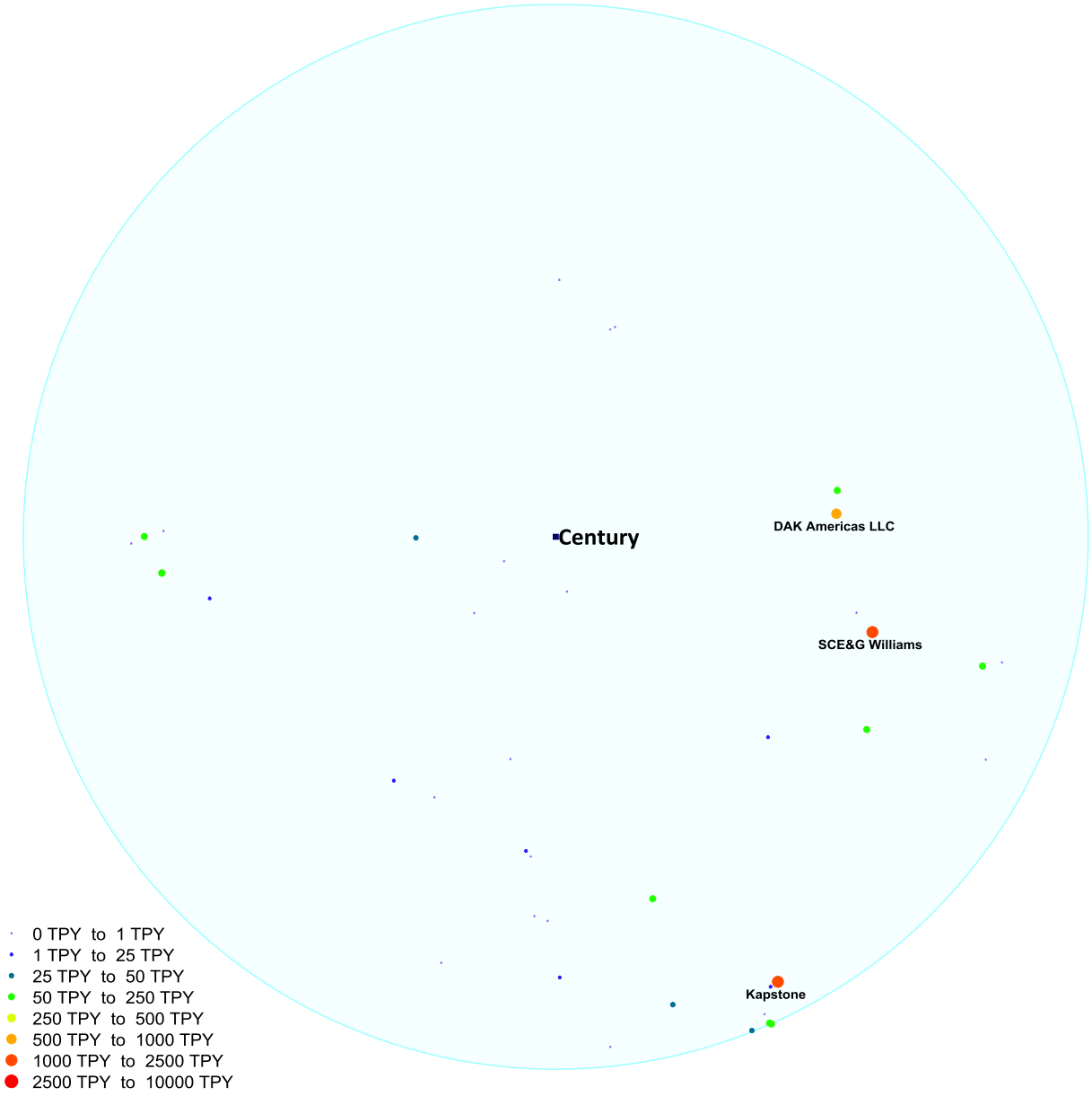

Figure 8 Annual SO_2 emissions (2014 actual emissions, when available, or allowable emissions) for permitted facilities within 20 km of Century

Figure 7 shows that the nearby facilities that are candidates for inclusion in the modeling are scattered throughout the 50 km screening area. Although distance is one factor to consider when selecting sources, the magnitude of their emission rates is another.

Actual annual SO_2 emission rates for the years 2012, 2013, and 2014 were obtained for each of the candidate facilities from DHEC BAQ and then analyzed for the emission rate in the most recent year for which data are available (2014). Figure 9 shows the candidate sources with emissions greater than 10 TPY and is coded to reflect the actual annual facility-wide emission rate in 2014. Large white circles are used to identify sources that had actual SO_2 emission rates exceeding 2,000 TPY in 2014. Sources that had actual SO_2 emission rates between 1,000 TPY and 2,000 TPY in 2014 are depicted by a smaller red circle. Sources that had actual SO_2 emission rates between 100 TPY and 1,000 TPY in 2014 are depicted by a smaller purple circle. Sources with actual annual SO_2 emission rates greater than 10 TPY but less than 100 TPY in 2014 are depicted by smaller blue circles. Sources with actual 2014 SO_2 emission rates less than 10 TPY are not shown in Figure 9 but are included in Figure 7. Figure 9 shows that some of the candidate sources are located in the outer portion of the screening area.

Guidance in the TAD suggests focusing on sources within 10 to 20 km of the primary source when identifying other sources to include in the modeling analysis for determining attainment for the 1-hour SO_2 NAAQS. Figure 10 shows the region within 20 km of Century. Circles with radii of 10 km and 20 km from Century are plotted as well. There are no candidate sources with emission rates greater than 10 TPY within 10 km of Century and five sources within 20 km. Figure 11 shows an analysis, in the form of a pie chart, of relative actual emission rates in 2014 from sources with emission rates greater than 10 TPY within the screening area. Century accounted for 24.5% of the SO_2 emissions in this analysis and the largest source in the screening area, Santee Cooper Cross Generating Station, accounted for 39.0% of the SO_2 emissions.

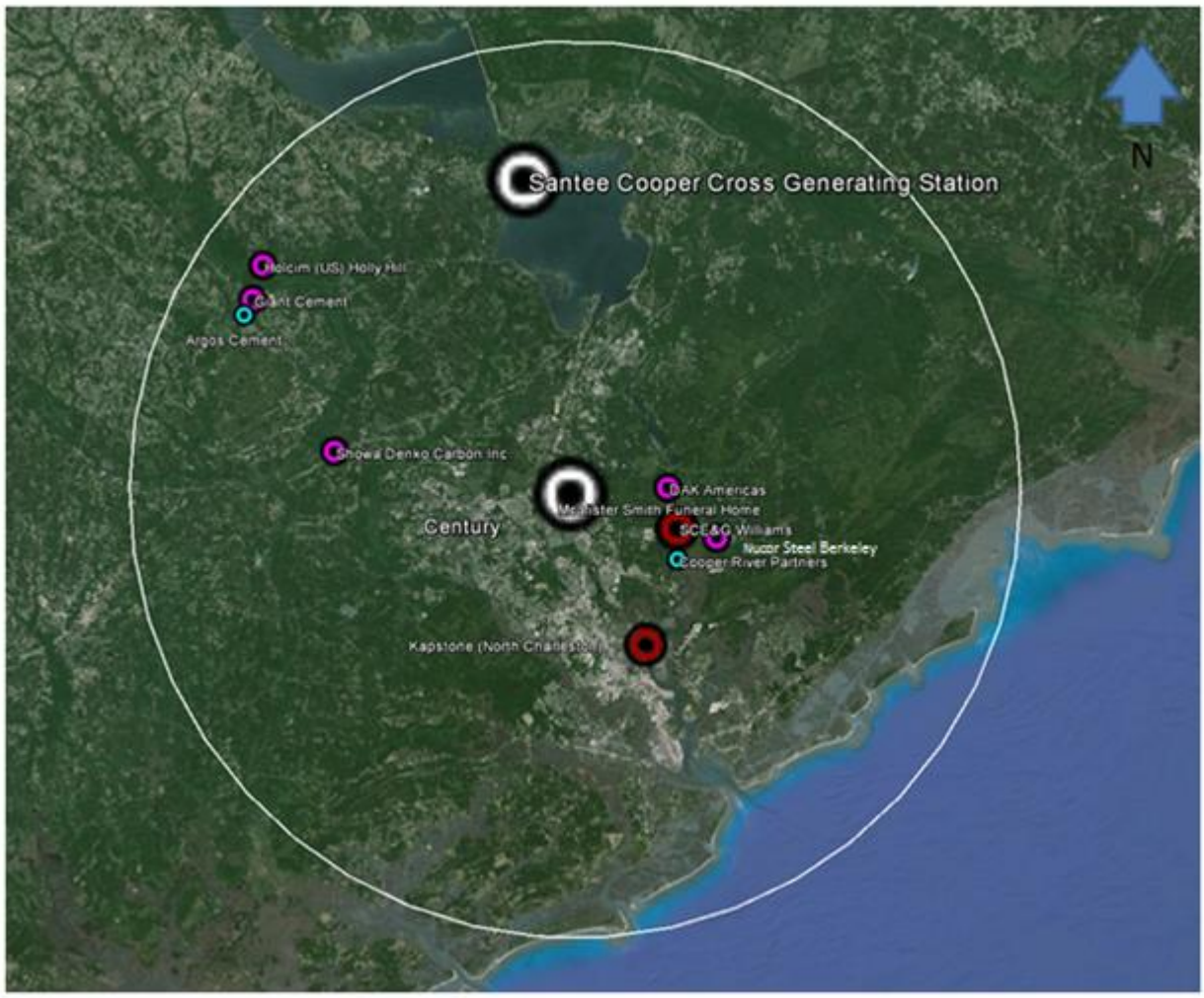

Figure 9 Candidate background sources with emission rates greater than 10 TPY within 50 km of Century

Actual SO_2 Emissions > 2,000 tpy

2,000 tpy > Actual SO_2 Emissions > 1,000 tpy

1,000 tpy > Actual SO_2 Emissions > 100 tpy

100 tpy > Actual SO_2 Emissions > 10 tpy

Figure 10 Candidate background sources with emission rates greater than 10 TPY nearest to Century (circles at 10 km and 20 km)

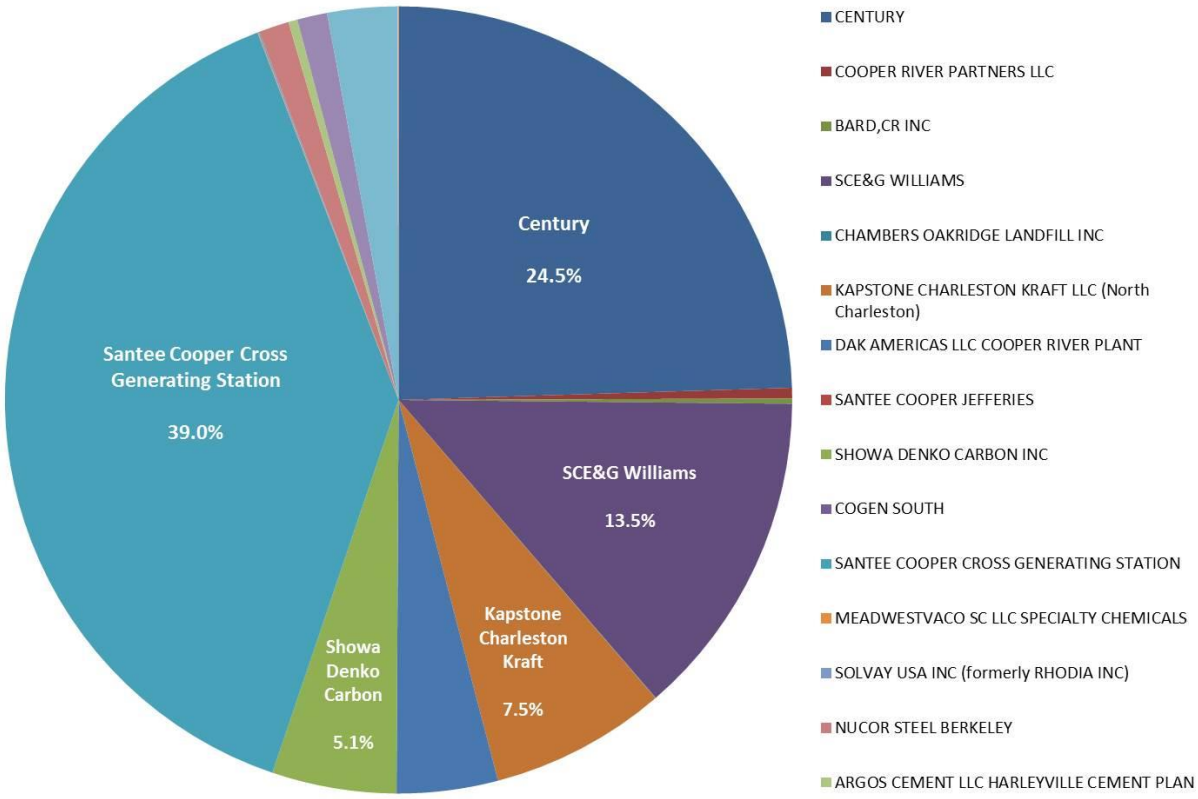

Figure 11 Relative 2014 actual SO_2 emissions for sources greater than 10 TPY within screening area

3.1.5 20D Methodology

Although the initial consideration of emission rates and proximity to the primary sources suggests that few, if any, nearby sources need to be included in the cumulative impact analysis, an objective method was used to exclude some of the sources within the screening area.

A method commonly used and recommended by DHEC BAQ for screening nearby sources for inclusion in a cumulative impact analysis is the "20D" methodology. Originally developed by the North Carolina Department of Environment and Natural Resources, the 20D method allows for candidate nearby sources to be excluded from the cumulative analysis if their facility-wide emission rates, in tons per year, are less than 20D, where D is the distance in km between the candidate nearby source and the primary source

Facilities located beyond 50 km from Century were excluded from consideration. As shown in Figure 7, there are only five facilities within 50 km of Century with annual SO_2 emissions greater than 500 TPY based on actual 2014 annual emissions, where available, or otherwise based on allowable emissions. Given the locations of these five facilities relative to Century, their plumes would not be expected to merge or interact significantly in the vicinity of Century. Relative to Century, Showa Denko Carbon Inc. (Showa Denko) is located about 27 km to the west (bearing 290^{o}), Santee Cooper Cross Generating Station (Santee Cooper Cross) is located about 35 km to the north (bearing 351^{o}), and Kapstone Charleston Kraft LLC North Charleston (Kapstone) is located about 19 km to the south-southeast (bearing 153^{o}). These three facilities are all isolated relative to each other and Century. Relative to Century, DAK Americas LLC Cooper River Plant (DAK Americas) is located about 11 km to the east (bearing 86^{o}), and South Carolina Electric & Gas Williams Station (SCE&G Williams) is located about 12 km to the east-southeast (bearing 107^{o}). Relative to SCE&G Williams, DAK Americas is located approximately 5 km to the north-northwest (bearing 345^{o}). Given the relative locations of these two facilities, it is not expected that their plumes would experience significant overlap at the location of Century from any upwind direction. Therefore, there are no clusters of large candidate background facilities located far from Century in the same upwind direction such that the plumes would be expected to merge or overlap substantially at the location of Century. As a

result, the emissions from each candidate background facility were considered separately in determining Q in the Q/D calculation.

Table 2 lists all permitted facilities located within 50 km of Century with their allowable and, where available, 2012-2014 actual annual SO_2 emissions in TPY and distance from Century. Table 2 also summarizes the results of the 20D analysis described below.

To ensure that all facilities with current air permits were considered, the 20D analysis was initially conducted using current allowable annual emissions provided by DHEC BAQ for facilities with air permits in each county. All but eleven candidate background facilities were excluded from the cumulative impact analysis based on the 20D analysis using allowable annual emissions.

The 20D analysis was then repeated for these eleven remaining facilities using actual annual SO_2 emissions from 2014 provided by DHEC BAQ. Emissions from 2014 are most representative of current operations, especially since some sources have recently switched to lower sulfur fuel or shut down operations. It is worth noting that some sources that had sizable SO_2 emissions in the past, such as Santee Cooper Jefferies and Cogen South, have greatly reduced their actual emissions to the point that they can be excluded from the cumulative impact modeling analysis. Santee Cooper Jefferies shut down its two coal-fired units at the end of 2012, and its two oil-fired units appear to be inactive as well. DHEC BAQ annual emission inventory data show no SO_2 emissions from Cogen South in 2012, 2013, or 2014 and the facility no longer has an active air permit. Using 2014 actual annual emissions, six of the remaining eleven candidate background facilities screened out based on 20D.

The remaining five sources under consideration at this stage of the screening were:

- DAK Americas, about 11 km away,
- SCE&G Williams, about 12 km away,
- Kapstone, about 19 km away,
- Showa Denko, about 27 km away, and
- Santee Cooper Cross, about 35 km away.

Table 2 Summary of 20D Screening Analysis

Company Name	Permit #	County Name	UTM-17N (NAD83) East (m)	UTM-17N (NAD83) North (m)	Distance from Century (km)	20D for Century (km)	Allowable SO_2 TPY	2012 Actual SO_2 TPY	2013 Actual SO_2 TPY	2014 Actual SO_2 TPY	EXCLUDE by 20D based on Allowable	EXCLUDE by 20D based on 2014 Actual
JW ALUMINUM	0420-0033	Berkeley	588735.7	3655206.4	2.1	42.1	111.87	0.28	0.28	0.32	NO	YES
McAllister Smith Funeral Home Goose Creek	0420-0107	Berkeley	586370.0	3656350.0	2.2	43.0	0.83				YES	
AAI Corporation	0420-0071	Berkeley	585250.0	3654400.0	4.2	84.0	0.10				YES	
Sanders Brothers	9900-0227	PORTABLE	583061.0	3657227.0	5.3	105.1	30.35				YES	
Berkeley Co. Water & Sanitation Authority	0420-0059	Berkeley	590361.0	3665052.0	8.0	161.0	24.57	0.50	0.50	0.02	YES	
Santee Cooper Berkeley County Landfill Gas Electric Generation Facility	0420-0112	Berkeley	590537.5	3665146.0	8.2	163.7	0.11	0.26	0.26	0.03	YES	
Trident Medical Center	0560-0138	Charleston	586610.7	3648914.6	8.5	170.5	0.11				YES	
BioEnergy Technologies	0420-0120	Berkeley	588448.0	3666915.0	9.6	192.9	0.04				YES	
DAK Americas LLC	**0420-0089**	**Berkeley**	**598854.0**	**3658133.5**	**10.6**	**211.5**	**4,241.42**	**572.65**	**580.38**	**594.29**	**NO**	**NO**
E.I.Dupont	0420-0011	Berkeley	598885.8	3659006.7	10.7	214.3	66.93				YES	
Mercedes-Benz Vans Manufacturing, LLC	0560-0385	Charleston	583759.0	3647475.0	10.8	216.0	0.04				YES	
Joint Base Charleston-Weapons	0420-0014	Berkeley	596285.6	3649737.6	11.0	219.3	19.67				YES	
Cummins Turbo Technologies	0560-0384	Charleston	582230.7	3648106.6	11.0	220.0	3.96				YES	
SC Pipeline Corp.	0420-0048	Berkeley	599609.1	3654412.0	11.7	233.0	0.20	0.01	0.01	0.01	YES	
Carolina Starches	0560-0240	Charleston	587195.7	3645466.6	11.9	237.1	2.32				YES	
National Starch, LLC	0560-0298	Charleston	587376.5	3645258.5	12.0	240.9	0.09				YES	
SCE&G Williams	**0420-0006**	**Berkeley**	**600207.5**	**3653687.1**	**12.4**	**248.4**	**17,743.20**	**1030.93**	**908.07**	**1933.61**	**NO**	**NO**
Kapstone Summerville Lumber Mill	0900-0017	Dorchester	575314.7	3654951.3	13.2	264.1	8.69	3.94	3.94	5.56	YES	
Cooper River Partners	0420-0113	Berkeley	599995.0	3650028.0	13.7	274.9	2,097.80	47.12	47.12	62.01	NO	YES
Hanahan Water Treatment	0420-0072	Berkeley	591956.7	3643671.6	14.1	281.5	122.99				YES	
BASF North Charleston	0560-0209	Charleston	587512.2	3643016.0	14.3	285.5	0.10				YES	
Everris NA Inc.	0560-0205	Charleston	588010.7	3642838.3	14.4	288.7	0.11				YES	
Raisio Staest US Inc	0900-0063	Dorchester	573580.0	3657480.0	14.7	294.7	0.31				YES	
Banks Construction Co.	9900-0461	Dorchester	573518.0	3655905.0	14.9	297.2	101.62				YES	
Banks Construction Co. -- Summerville	9900-0461	PORTABLE	573518.0	3655905.0	14.9	297.2	101.62				YES	

Table 2 (cont'd.) Summary of 20D Screening Analysis

Company Name	Permit #	County Name	UTM-17N (NAD83) East (m)	UTM-17N (NAD83) North (m)	Distance from Century (km)	20D for Century	Allowable SO_2 TPY	2012 Actual SO_2 TPY	2013 Actual SO_2 TPY	2014 Actual SO_2 TPY	EXCLUDE by 20D based on Allowable	EXCLUDE by 20D based on 2014 Actual
Cemplank Inc.	0900-0069	Dorchester	572861.0	3657278.0	15.5	309.1	52.25				YES	
Linq Industrial Fabrics, Inc.	0900-0016	Dorchester	572370.0	3657010.0	15.9	318.9	0.03				YES	
Charleston AFB	0560-0019	Charleston	588463.6	3640714.1	16.6	331.1	17.70				YES	
Robert Bosch Corporation	0900-0020	Dorchester	584009.3	3641259.3	16.6	331.6	20.06	0.04	0.04	0.47	YES	
Nucor Steel	0420-0060	Berkeley	604344.4	3652411.4	16.7	335.0	613.12	205.90	188.61	177.67	NO	YES
Air Liquide Large	0420-0064	Berkeley	605076.0	3652546.0	17.4	348.3	0.18				YES	
Sanders Brothers Construction	9900-0234	Charleston	592711.0	3639694.0	18.1	362.3	30.36				YES	
BP-Amoco Cooper River	0420-0029	Berkeley	604465.5	3648893.3	18.2	363.9	2416.17	0.98	0.68	0.77	NO	YES
Kapstone	**0560-0008**	**Charleston**	**596658.3**	**3640550.3**	**18.7**	**373.7**	**10997.31**	**1087.07**	**992.39**	**1038.11**	**NO**	**NO**
MeadWestvaco Chemical Division	0560-0164	Charleston	596381.3	3640363.8	18.7	374.6	304.17	3.18	3.18	3.95	YES	
The Boeing Company	0560-0372	Charleston	590362.3	3638101.7	19.3	385.5	0.38				YES	
Kinder Morgan Bulk Terminals	0560-0038	Charleston	596153.0	3639332.5	19.6	391.5	0.01				YES	
Buckeye Terminals	0560-0022	Charleston	596345.0	3639002.0	20.0	399.1	120.01				YES	
ALSCO	0560-0037	Charleston	595681.0	3638720.0	20.0	399.2	46.65				YES	
Delfin Group	0560-0039	Charleston	596416.7	3638965.5	20.0	400.3	93.08				YES	
Odfjell Terminals	0560-0421	Charleston	596453.0	3638452.5	20.5	410.0	188.38				YES	
Banks Construction Co.	9900-0322	Charleston	592710.5	3636440.5	21.3	425.7	131.46				YES	
Siebe-North, Inc.-Butyl 2	0560-0166	Charleston	592008.0	3636245.0	21.3	426.9	37.32	0.03	0.03	0.08	YES	
Santee Cooper - Jefferies	0420-0003	Berkeley	594354.0	3678587.7	22.2	443.2	10965.77	4229.07	0.07	0.07	NO	YES
Naval Health Clinic	0560-0249	Charleston	595520.0	3636000.0	22.5	449.1	92.90				YES	
Deytens Shipyards	0560-0236	Charleston	596872.6	3636499.4	22.5	449.3	80.73	0.35	0.35	0.22	YES	
Charleston County Detention Center	0560-0373	Charleston	592262.0	3634621.0	23.0	459.8	12.83				YES	
Cummins, Inc.	0560-0361	Charleston	591120.7	3634418.8	23.0	460.4	1.14				YES	
Salisbury Electrical Safety, LLC	0560-0032	Charleston	593384.7	3634599.3	23.2	464.6	6.71	0.05	0.08	0.18	YES	
Saint-Gobain Adfors America	0560-0026	Charleston	593014.0	3634152.0	23.6	471.8	0.08	0.02	0.02	0.02	YES	
Tarmac America	0560-0110	Charleston	596617.0	3634319.0	24.4	488.1	4.38				YES	
Solvay	0560-0011	Charleston	596804.8	3633229.3	25.5	509.9	330.47	2.14	1.09	8.60	YES	

Table 2 (cont'd.) Summary of 20D Screening Analysis

Company Name	Permit #	County Name	UTM-17N (NAD83) East (m)	UTM-17N (NAD83) North (m)	Distance from Century (km)	20D for Century	Allowable SO_2 TPY	2012 Actual SO_2 TPY	2013 Actual SO_2 TPY	2014 Actual SO_2 TPY	EXCLUDE by 20D based on Allowable	EXCLUDE by 20D based on 2014 Actual
SCE&G - Hagood	0560-0029	Charleston	597064.6	3632565.8	26.2	524.1	2934.47	0.75	0.75	0.51	NO	YES
Chevron USA	0560-0020	Charleston	598755.0	3632791.0	26.6	532.2	253.03				YES	
Bon Secours St. Francis Xavier	0560-0242	Charleston	589663.7	3630384.5	26.9	538.4	7.45				YES	
Kinder Morgan Operating LP	0560-0015_0027	Charleston	598600.7	3632270.7	27.0	540.6	36.66				YES	
Showa Denko Carbon	**0900-0025**	**Dorchester**	**561439.1**	**3661479.9**	**27.2**	**544.1**	**1116.68**	**951.85**	**863.50**	**731.61**	**NO**	**NO**
Petroliance LLC	0560-0221	Charleston	598762.8	3632008.5	27.3	546.7	27.77				YES	
The Citadel	0560-0007	Charleston	597093.3	3629318.3	29.3	585.9	6.70				YES	
Chambers Oakridge Landfill	0900-0058	Dorchester	559524.5	3665496.8	29.9	598.9	59.35	1.96	1.96	2.36	YES	
R.H. Johnson VA Medical Center	0560-0047	Charleston	598008.7	3627864.8	31.0	619.2	94.84				YES	
Medical University of South Carolina	0560-0024	Charleston	598451.0	3627921.2	31.0	621.0	53.35				YES	
Roper Hospital	0560-0046	Charleston	598347.8	3627773.5	31.2	623.1	14.00				YES	
Charleston Memorial Hospital	0560-0131	Charleston	598208.0	3627677.0	31.2	624.0	11.62				YES	
MUSC Rutledge Towers	0560-0133	Charleston	598783.0	3627812.0	31.3	625.2	38.41				YES	
College of Charleston	0560-0324	Charleston	599550.0	3627800.0	31.5	630.8	64.82				YES	
East Cooper Regional Medical Center	0560-0410	Charleston	607554.5	3632090.5	31.7	633.8	26.63				YES	
Pilgrim's Pride Feed Mill	2140-0044	Sumter	554583.8	3661023.2	33.9	678.8	46.47				YES	
Santee Cooper-Cross	**0420-0030**	**Berkeley**	**582446.3**	**3692281.0**	**35.5**	**710.0**	**15487.77**	**8018.69**	**6687.58**	**5577.44**	**NO**	**NO**
SC Department of Natural Resources	0560-0173	Charleston	603115.0	3624299.0	36.1	722.8	24.44				YES	
Meadwestvaco/Badham Chip Mill	0740-0036	Colleton	551191.2	3656120.1	37.1	742.8	4.37				YES	
Banks Construction - DSM Drying Operations	1860-0133	Orangeburg	570337.0	3690844.0	38.1	761.7	214.62				YES	
Giant Cement	0900-0002	Dorchester	552064.0	3678323.0	41.9	838.4	2372.93	354.08	417.48	411.14	NO	YES
Argos Cement	0900-0004	Dorchester	550988.8	3676423.9	42.0	839.1	3355.47	42.39	42.39	52.84	NO	YES
Albany Int'l-Press Fabrics	0420-0009	Berkeley	599948.4	3698067.1	42.4	848.5	191.41				YES	
SRE Dorchester	0900-0102	Dorchester	550802.0	3678037.0	42.9	857.6	30.13				YES	
Holcim, Inc.	1860-0005	Orangeburg	553134.2	3682366.5	43.2	864.3	4012.27	90.46	116.33	176.72	NO	YES

Table 2 (cont'd.) Summary of 20D Screening Analysis

Company Name	Permit #	County Name	UTM-17N (NAD83) East (m)	UTM-17N (NAD83) North (m)	Distance from Century (km)	20D for Century	Allowable SO_2 TPY	2012 Actual SO_2 TPY	2013 Actual SO_2 TPY	2014 Actual SO_2 TPY	EXCLUDE by 20D based on Allowable	EXCLUDE by 20D based on 2014 Actual
Brewer Properties/Roseburg Forest Products	1860-0038	Orangeburg	552575.0	3682175.0	43.6	871.2	36.75	0.00	0.00	0.00	YES	
Chargeurs Wool USA, Inc (formerly Prouvost USA)	0420-0001	Berkeley	622571.9	3684225.8	43.6	871.8	40.97				YES	
Carolina Pole, Inc	1860-0059	Orangeburg	559510.0	3692946.0	45.9	917.1	229.97				YES	
Pennington Crossarm Co.	1860-0096	Orangeburg	552492.5	3688922.9	47.8	956.1	18.66				YES	
Dorchester Compressor Station	0900-0115	Dorchester	544496.3	3676692.0	47.9	958.6	0.58				YES	
Roper St. Francis Hospital	0560-0413	Charleston	633149.5	3638453.0	48.6	972.5	16.12				YES	

3.1.6 Concentration Gradient Analysis

The initial 20D analysis described above shows that all but five SO_2 sources in the 50 km screening area surrounding Century can be excluded from the cumulative impact analysis. However, some of the sources still under consideration are located well beyond the 10 km radius that the TAD suggests should be the focus for identifying sources for inclusion in the modeling.

Sources located more than 10 km from the primary source in a modeling analysis are unlikely to have significant concentration gradients in the vicinity of the primary source. In accordance with EPA guidance in or referenced by the TAD, Century conducted additional analyses that examined the concentration gradients predicted for each of the remaining candidate sources.

For Showa Denko, Stack S-430-03 was identified as the largest SO_2 emitting stack, and its physical stack parameters and associated stack gas flow parameters were used in the dispersion modeling to examine the concentration gradients associated with this facility. The stack parameters and current short-term allowable facility-wide SO_2 emission rate used in the gradient analysis are listed in Table 3.

For SCE&G Williams, Utility Boiler #1 was identified as the largest SO_2 emitting stack, and its physical stack parameters and associated stack gas flow parameters were used in the dispersion modeling to examine the concentration gradients associated with this facility. Actual hourly SO_2 emissions were obtained from EPA's Air Markets Program Database (AMPD) for 2012-2014. The allowable SO_2 emissions from the units reporting to AMPD account for nearly all (99.9%) of the allowable SO_2 emissions from the facility. The modeled stack parameters are shown in Table 4, and actual facility-wide hourly emissions were used in the modeling.

For Santee Cooper Cross, there are four stacks (Units 1-4) that emit SO_2, and the physical stack parameters and associated stack gas flow parameters for each unit were included in the dispersion modeling to examine the concentration gradients associated with this facility. Actual hourly SO_2 emissions were obtained from AMPD for 2012-2014. The allowable SO_2 emissions from the units reporting to AMPD account for all (100%) of the allowable SO_2 emissions from

the facility. The modeled stack parameters are shown in Table 5, and actual hourly emissions were used in the modeling.

For DAK Americas, Boiler 2 was identified as the largest SO_2 emitting stack, and its physical stack parameters and associated stack gas flow parameters were used in the dispersion modeling to examine the concentration gradients associated with this facility. DHEC BAQ provided monthly reported actual facility-wide SO_2 emission rates for 2012-2014 (see Appendix A). For each month, a representative emission rate in units of lb/hr was computed by converting the reported actual SO_2 emissions in tons to pounds and dividing by the number of hours in the month. The modeled stack parameters are shown in Table 6, and the modeled facility-wide emission rates for each month are shown in Table 7.

For Kapstone, there are ten stacks that emit SO_2. The physical stack parameters and associated stack gas flow parameters for each stack were included in the dispersion modeling to examine the concentration gradients associated with this facility. Kapstone provided actual hours of operation and annual SO_2 emissions for 2012-2014. Representative lb/hr SO_2 emission rates were computed for each year and source by dividing the actual annual SO_2 emissions by the actual hours of operation. As an added level of conservatism, the maximum hourly emission rate over the three modeled years was selected for each source for inclusion in the modeling. The modeled stack parameters are shown in Table 8, and the modeled emission rates for each source are shown in Table 9.

Table 3 Showa Denko Concentration Gradient Modeling Stack Parameters and Emission Rate

Facility Name	Source Name	UTM-E (m)	UTM-N (m)	Stack Base Elevation (m)	Stack Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Exit Diameter (m)	Modeled Emission Rate (g/s)
Showa Denko	S-430-03	561326	3661532	19.31	50.5	310.9	18.3	2.5	32.12

Table 4 SCE&G Williams Concentration Gradient Modeling Stack Parameters

Facility Name	Source Name	UTM-E (m)	UTM-N (m)	Stack Base Elevation (m)	Stack Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Exit Diameter (m)
SCE&G Williams	Utility Boiler #1	600177	3653478	3.59	121.9	326.5	17.6	7.9

Table 5 Santee Cooper Cross Concentration Gradient Modeling Stack Parameters

Facility Name	Source Name	UTM-E (m)	UTM-N (m)	Stack Base Elevation (m)	Stack Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Exit Diameter (m)
Santee Cooper Cross	Unit 1	582576	3692330	23.8	182.88	339.26	25.91	6.71
Santee Cooper Cross	Unit 2	582576	3692330	23.8	182.88	339.26	25.91	6.71
Santee Cooper Cross	Unit 3	582448	3692470	23.8	148.74	323.15	21.03	7.62
Santee Cooper Cross	Unit 4	582448	3692470	23.8	148.74	323.15	21.03	7.62

Table 6 DAK Americas Concentration Gradient Modeling Stack Parameters

Facility Name	Source Name	UTM-E (m)	UTM-N (m)	Stack Base Elevation (m)	Stack Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Exit Diameter (m)
DAK Americas	Boiler 2	598851	3658142	6.91	45.7	433.2	13.0	1.5

Table 7 DAK Americas Concentration Gradient Modeling Emission Rates

Month-Year	Actual Monthly SO_2 (tons/month)	Modeled Hourly SO_2 (lb/hr)	Modeled Hourly SO_2 (g/s)
Jan-12	63	1.694E+02	2.134E+01
Feb-12	63	1.810E+02	2.281E+01
Mar-12	60	1.613E+02	2.032E+01
Apr-12	50	1.389E+02	1.750E+01
May-12	51	1.371E+02	1.727E+01
Jun-12	45	1.250E+02	1.575E+01
Jul-12	35	9.409E+01	1.185E+01
Aug-12	41	1.102E+02	1.389E+01
Sep-12	45	1.250E+02	1.575E+01
Oct-12	52	1.398E+02	1.761E+01
Nov-12	58	1.611E+02	2.030E+01
Dec-12	57	1.532E+02	1.931E+01
Jan-13	52	1.398E+02	1.761E+01
Feb-13	45	1.339E+02	1.687E+01
Mar-13	56	1.505E+02	1.897E+01
Apr-13	49	1.361E+02	1.715E+01
May-13	51	1.371E+02	1.727E+01
Jun-13	47	1.306E+02	1.645E+01
Jul-13	46	1.237E+02	1.558E+01
Aug-13	46	1.237E+02	1.558E+01
Sep-13	42	1.167E+02	1.470E+01
Oct-13	57	1.532E+02	1.931E+01
Nov-13	61	1.694E+02	2.135E+01
Dec-13	64	1.720E+02	2.168E+01
Jan-14	84	2.258E+02	2.845E+01
Feb-14	55	1.637E+02	2.062E+01
Mar-14	67	1.801E+02	2.269E+01
Apr-14	57	1.583E+02	1.995E+01
May-14	53	1.425E+02	1.795E+01
Jun-14	39	1.083E+02	1.365E+01
Jul-14	46	1.237E+02	1.558E+01
Aug-14	44	1.183E+02	1.490E+01
Sep-14	36	1.000E+02	1.260E+01
Oct-14	26	6.989E+01	8.806E+00
Nov-14	40	1.111E+02	1.400E+01
Dec-14	49	1.317E+02	1.660E+01

Table 8 Kapstone Concentration Gradient Modeling Stack Parameters

Facility Name	Source Name	UTM-E (m)	UTM-N (m)	Stack Base Elevation (m)	Stack Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Exit Diameter (m)
Kapstone	83	596565	3640704	3.7	34.59	346.43	9.601	1.77
Kapstone	84	596489	3640729	3.7	64.89	481.32	20.757	1.83
Kapstone	85	596666	3640565	3.7	125.30	467.59	20.85	3.47
Kapstone	03	596694	3640614	3.7	77.11	434.43	26.40	3.05
Kapstone	01	596680	3640571	3.7	78.61	349.82	8.99	1.19
Kapstone	02	596669	3640578	3.7	78.61	349.82	8.99	1.19
Kapstone	04	596708	3640601	3.7	76.50	350.43	3.90	1.98
Kapstone	05	596704	3640604	3.7	76.50	350.43	4.18	1.98
Kapstone	51-106	596583	3640269	3.7	122.83	372.59	20.21	3.35
Kapstone	51-107	596492	3640315	3.7	74.07	460.93	20.82	3.05

Table 9 Kapstone Concentration Gradient Modeling Emission Rates

Facility Name	Source Name	2012 Actual Hours of Operation	2013 Actual Hours of Operation	2014 Actual Hours of Operation	2012 Actual Annual SO_2 (TPY)	2013 Actual Annual SO_2 (TPY)	2014 Actual Annual SO_2 (TPY)	Modeled Maximum Hourly SO_2 (g/s)
Kapstone	83	684.6	958.9	826.4	4.9	0.1	0.0	1.801E+00
Kapstone	84	8386.3	8242.9	7429.3	4.3	0.4	0.4	1.307E-01
Kapstone	85	8619.9	8300.5	8400.4	449.7	65.3	69.4	1.315E+01
Kapstone	03	8457.7	8341.9	8370.6	618.5	81.9	78.3	1.843E+01
Kapstone	01	8619.9	8300.5	8400.4	2.8	1.1	1.1	8.291E-02
Kapstone	02	8619.9	8300.5	8400.4	2.8	1.1	1.1	8.291E-02
Kapstone	04	8457.7	8341.9	8370.6	2.1	0.8	0.8	6.202E-02
Kapstone	05	8457.7	8341.9	8370.6	2.1	0.8	0.8	6.202E-02
Kapstone	51-106	8535.0	8472.0	8760.0	902.8	839.5	896.6	2.666E+01
Kapstone	51-107	2250.0	3234.0	2368.0	0.2	0.7	0.5	5.454E-02

Receptors were placed at 100 meter (m) intervals along a line from the candidate source to the primary source with additional receptors placed at 100m intervals along two adjacent (parallel) lines offset laterally by 100m on either side of the middle line. Figure 12 shows the receptor locations used in the concentration gradient modeling.

Modeling was conducted using current default options to predict the multi-year average of the 4^{th} high 1-hour concentration at each receptor. To calculate the longitudinal gradients at each receptor along the middle line, the difference in predicted concentrations at the surrounding two receptors along the middle line was divided by the distance between these two receptors (200m). For the calculation of the lateral gradients at each downwind distance at each receptor along the middle line, the difference in predicted concentrations at the surrounding two receptors on the lines parallel to the middle line was divided by the distance between these two receptors (200m).

Profiles showing the variation of concentration gradients with distance from the candidate source were then plotted to determine if the gradients in the vicinity of the primary source were still significant or if they had flattened out. The results of the concentration gradient analysis help determine whether a nearby source needs to be included in the cumulative impact analysis. If the longitudinal and lateral concentration gradients from a background source have flattened out in the vicinity of Century, this suggests the concentration gradients are no longer significant and that the background source can be excluded from the cumulative impact analysis. In addition, the predicted impact in the vicinity of Century due to the background source can be compared with the 1-hour SO_2 design value for the monitor selected for use in the cumulative impact modeling. If the predicted impact from the background source is less than the monitor design value, this suggests the ambient background air quality concentration can be assumed to include the impact of the background source and that the background source can be excluded from the cumulative impact modeling analysis.

For each remaining candidate background source, plots of predicted longitudinal and lateral concentration gradients are presented in Figure 13 - Figure 22. In these plots, distance from the background source increases from left to right along the x-axis. The figures also show the 3-

year average of the 99th percentile of the highest predicted daily 1-hour value at a receptor at Century printed in green below the point indicating the downwind distance to Century.

In each case, the gradients are highest near the candidate source and generally decrease with downwind distance. The predicted concentration gradients in the vicinity of Century (to the right of the plot) are much smaller than those in the vicinity of the background source, and the slope of the gradient near Century is much flatter than in the vicinity of the background source. This indicates that the concentration gradients from the candidate background sources are not significant in the vicinity of Century and that, as a result, the background sources do not need to be included explicitly in the cumulative impact modeling analyses.

For all five candidate background facilities, the predicted impacts at Century are well below the 1-hour SO_2 monitor design value of 37.5 µg/m^3 at the Jenkins Avenue Fire Station monitor (see Section 6.1). As discussed before, the plumes from the five candidate background facilities would not be expected to overlap or interact significantly at Century for any upwind direction. Therefore, it can be assumed that the ambient monitoring data incorporated in the cumulative impact analysis already accounts for the impacts of these candidate background sources. For this reason, they do not need to be included explicitly in the cumulative impact modeling analyses.

The predicted impacts at Century are also below or close to the interim 1-hour SO_2 Significant Impact Level (SIL) of 7.9 µg/m^3. If predicted impacts at Century from a potential background source are less than or on the order of the SIL, then the source either cannot or is unlikely to have a predicted impact that would cause or contribute to a predicted violation. The predicted impacts at Century of SCE&G Williams (4.3 µg/m^3) and Kapstone (6.6 µg/m^3) are both below the interim SIL. The predicted impact at Century from Showa Denko (9.4 µg/m^3) is slightly above the interim SIL, but the concentration gradient modeling for Showa Denko was based on the use of facility-wide allowable emissions. Given the nature and purpose of the DRR modeling, the use of actual emissions would be more appropriate. If the concentration gradient modeling was conducted using actual emissions from Showa Denko, the impact of Showa Denko at Century would be expected to be below the SIL. The highest actual annual facility-wide SO_2 emissions from Showa Denko over the 3-year modeling period (2012-2014) were 951.85 tons. The allowable SO_2 emission rate modeled in the concentration gradient analysis

(32.12 g/s) is 1116.6 TPY, which is greater than the maximum actual annual emissions over the modeling period. If the predicted impact from Showa Denko at Century (9.4 µg/m^3) is scaled by the ratio 951.85/1116.6 = 0.85 to better represent actual emissions, the resulting impact of 8.0 µg/m^3 would be very near to the interim 1-hour SO_2 SIL. The predicted impacts at Century of DAK Americas (9.9 µg/m^3) and Santee Cooper Cross (10.5 µg/m^3) exceed the interim SIL by only a slight margin. Therefore, as it is unlikely these facilities would cause or contribute to a predicted violation, there is no compelling reason to include them in the cumulative impact modeling analysis. For each candidate background source, the modeling demonstrates that the predicted 1-hour SO_2 impacts at the location of Century are both well below the 1-hour monitor design value and below or on the order of the 1-hour SO_2 SIL and therefore do not need to be explicitly included in the cumulative impact analysis.

In summary, the predicted lateral and longitudinal concentration gradients from each of the five candidate background sources have flattened in the vicinity of Century, and the predicted 1-hour SO_2 impacts at Century from each of the background sources are well below the monitor design value and below or on the order of the 1-hour SO_2 SIL. For these reasons, these five facilities were excluded from the cumulative impact analysis.

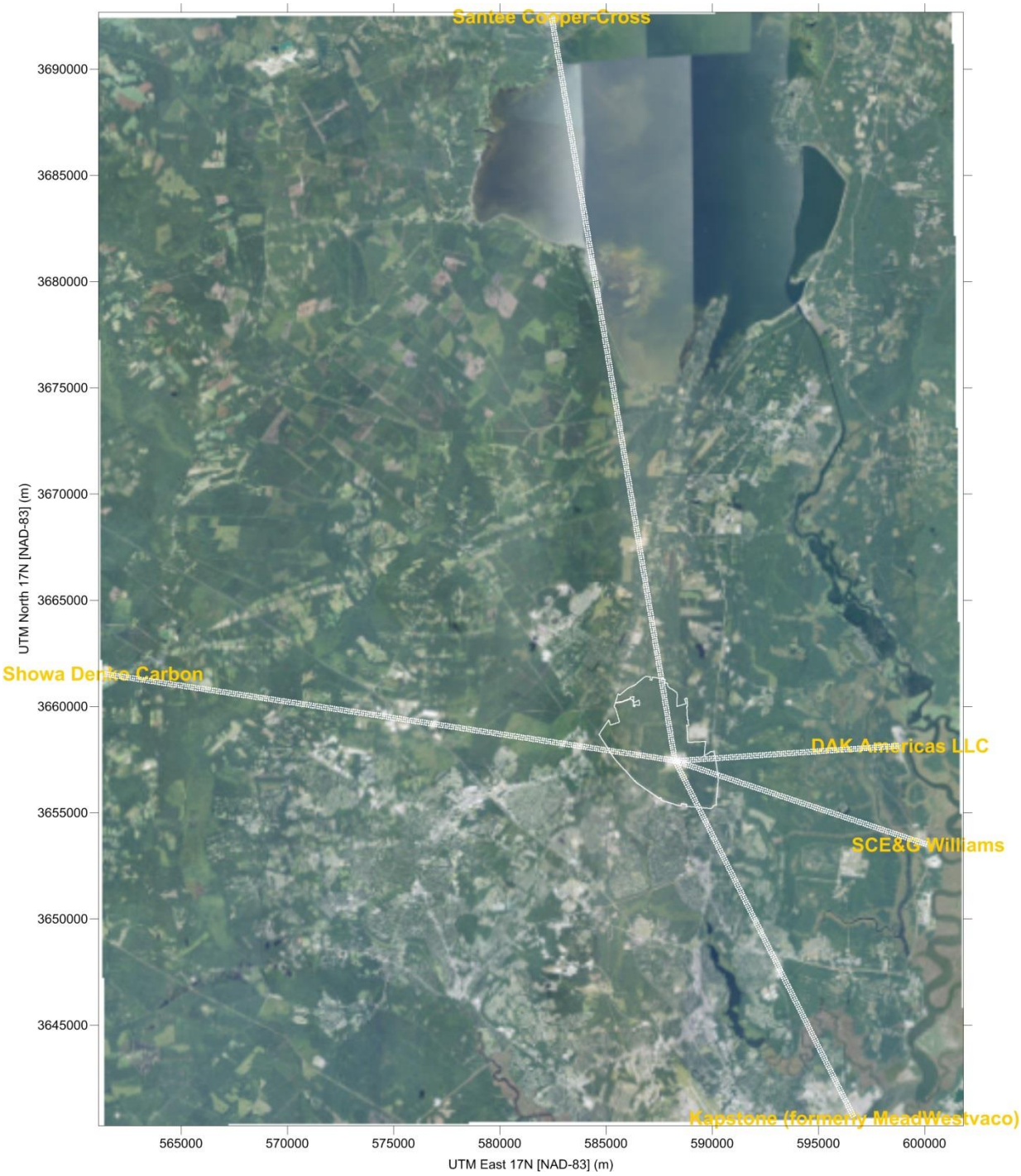

Figure 12 Lines of receptors used in concentration gradient analyses

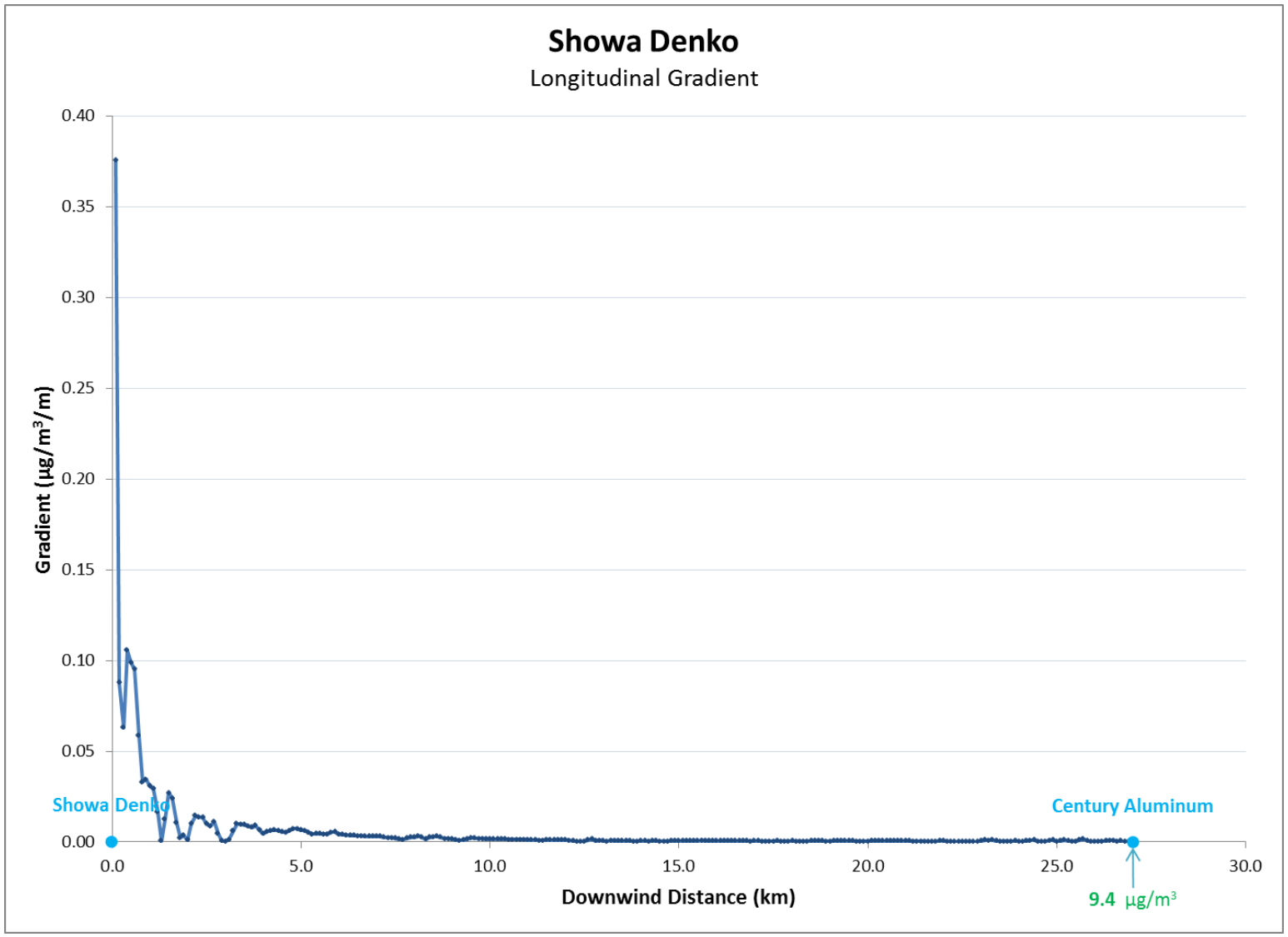

Figure 13 Longitudinal concentration gradient – Showa Denko

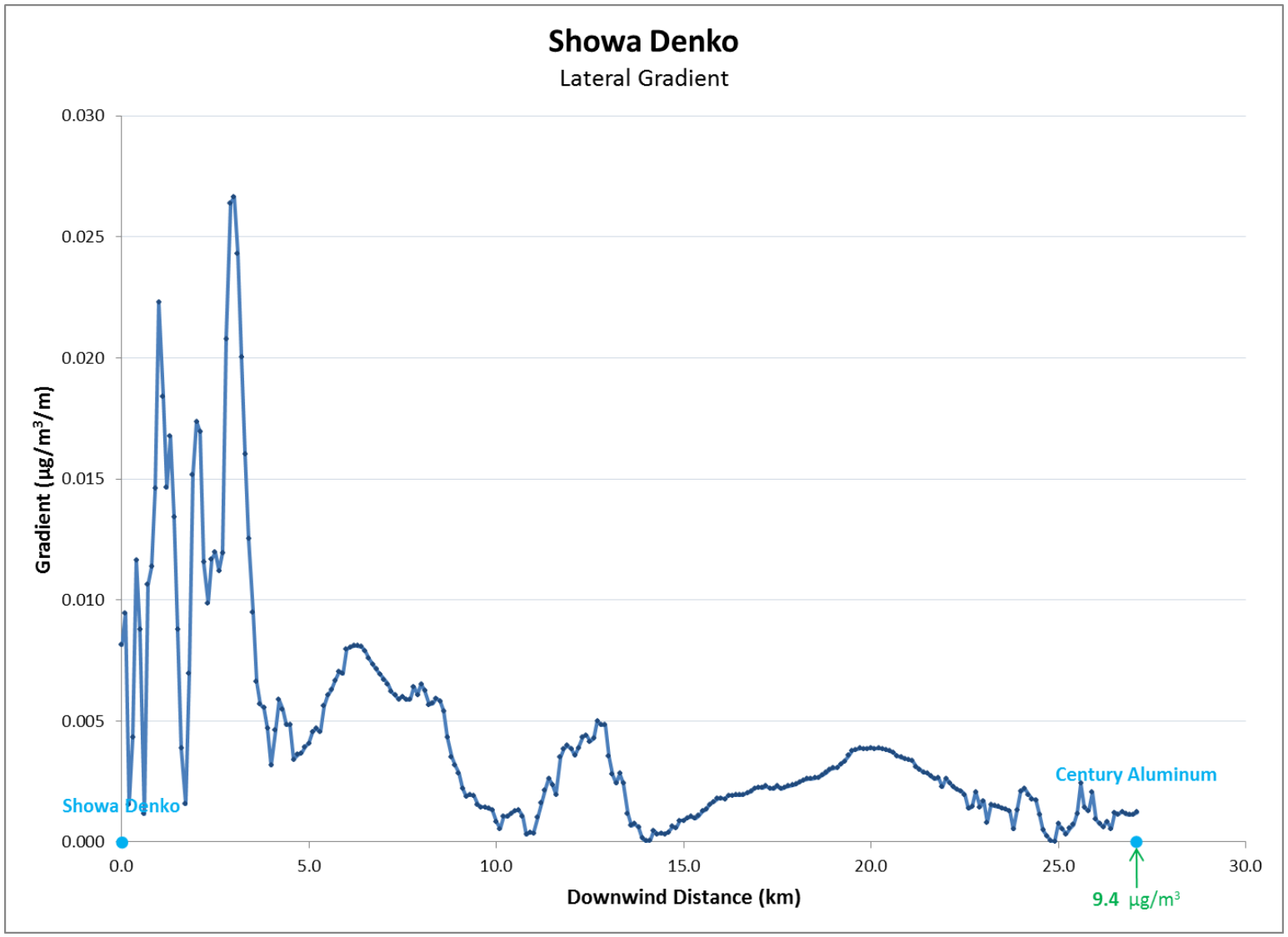

Figure 14 Lateral concentration gradient – Showa Denko

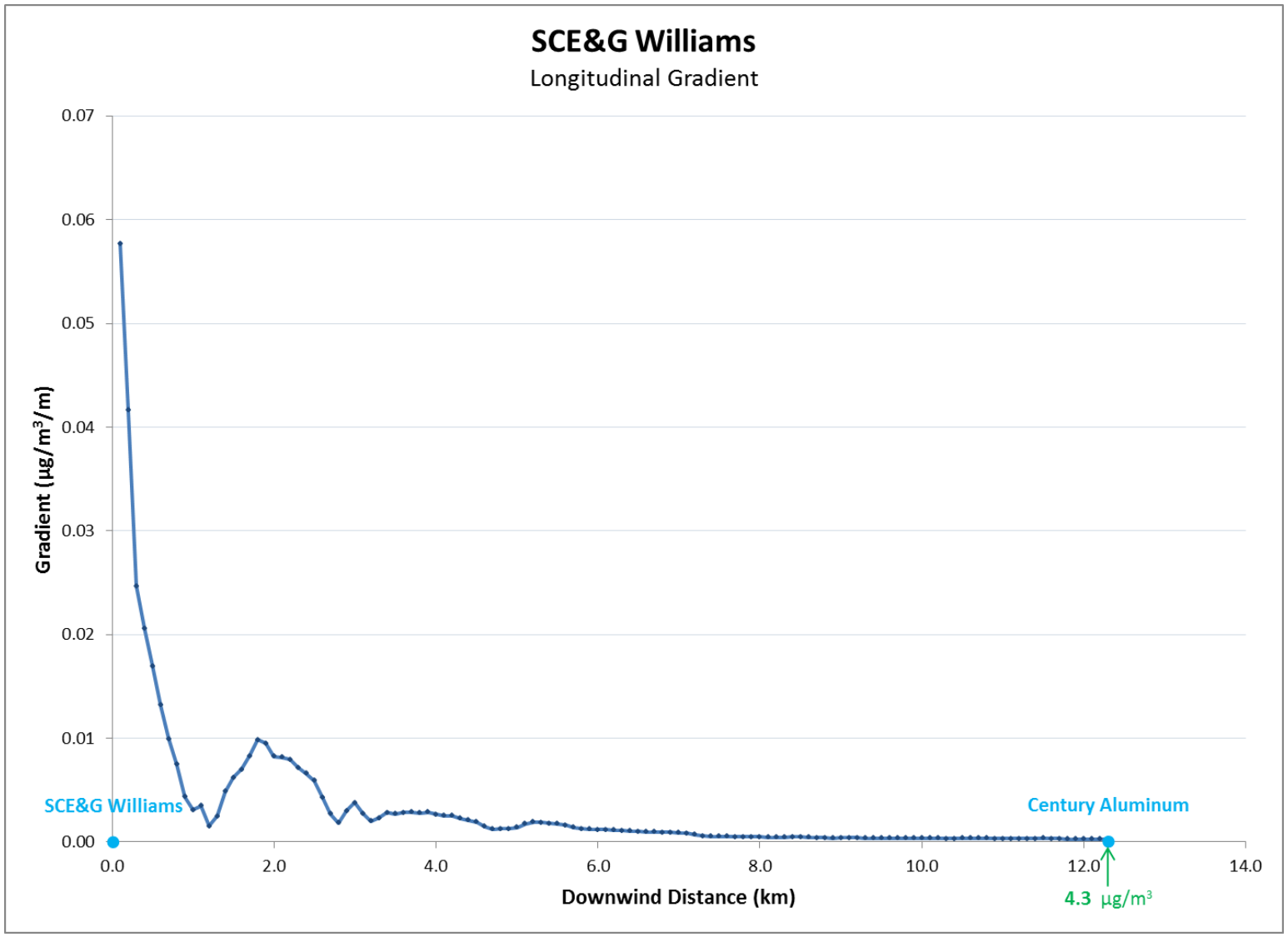

Figure 15 Longitudinal concentration gradient – SCE&G Williams

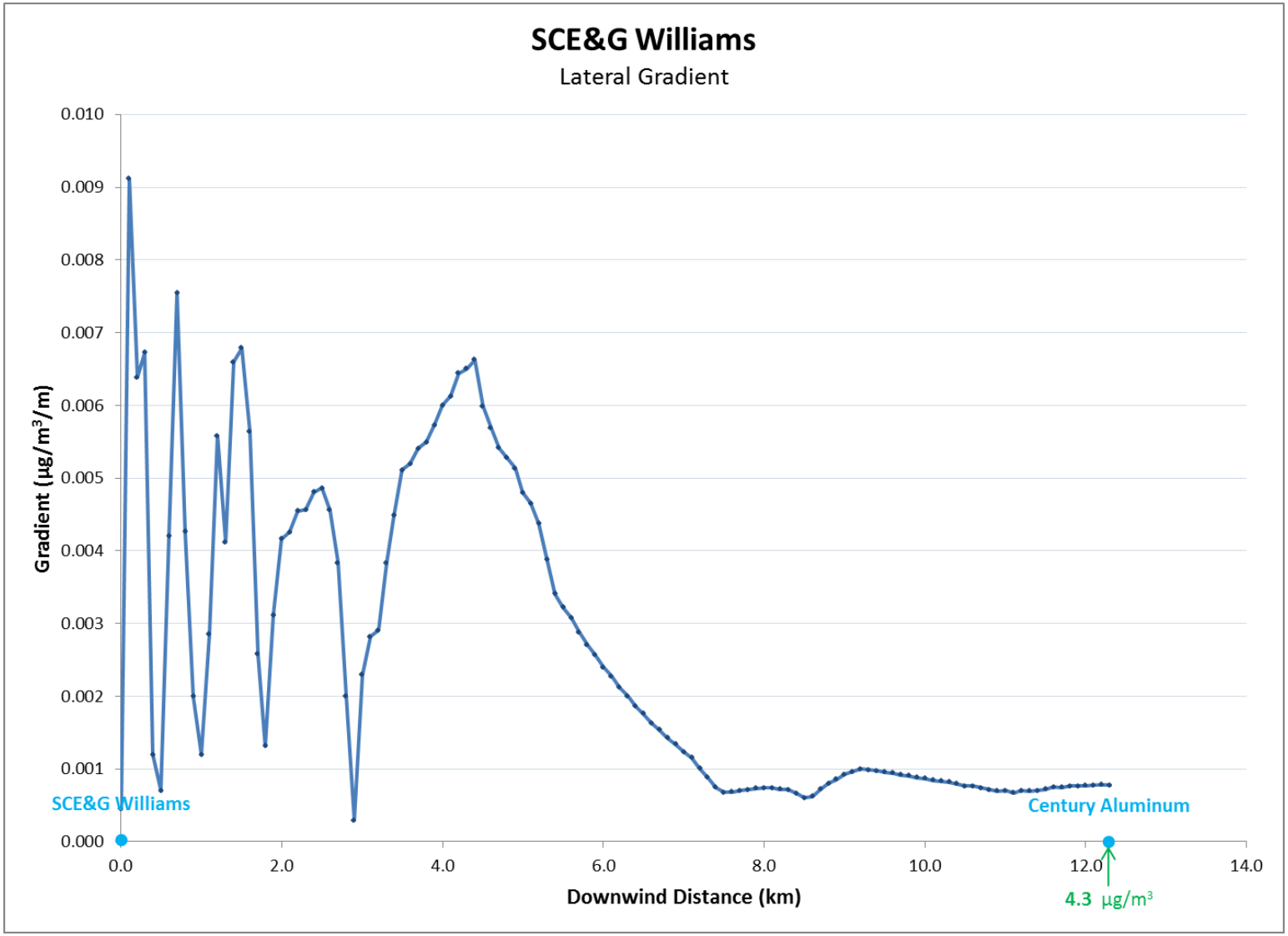

Figure 16 Lateral concentration gradient – SCE&G Williams

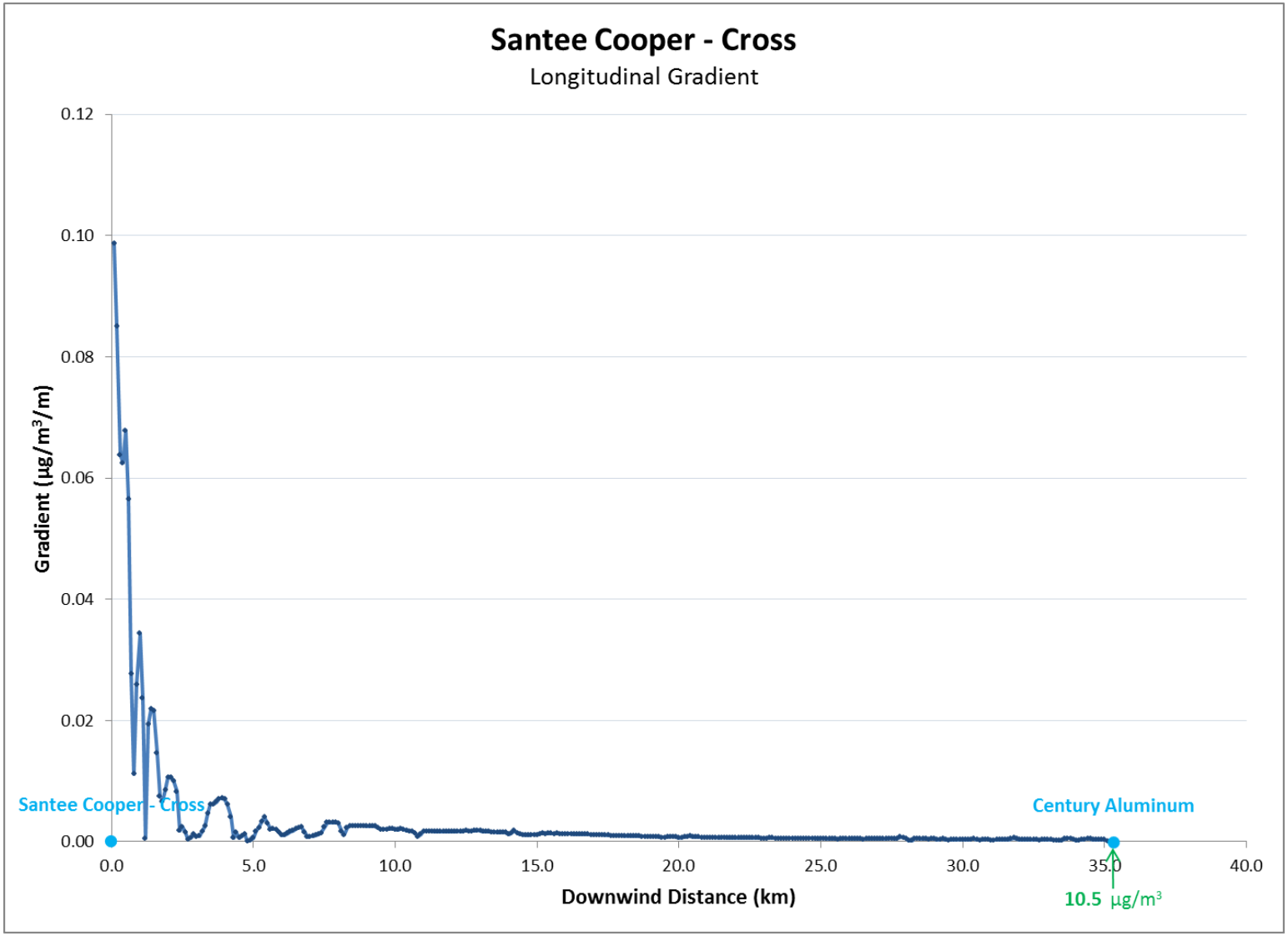

Figure 17 Lateral concentration gradient – Santee Cooper Cross

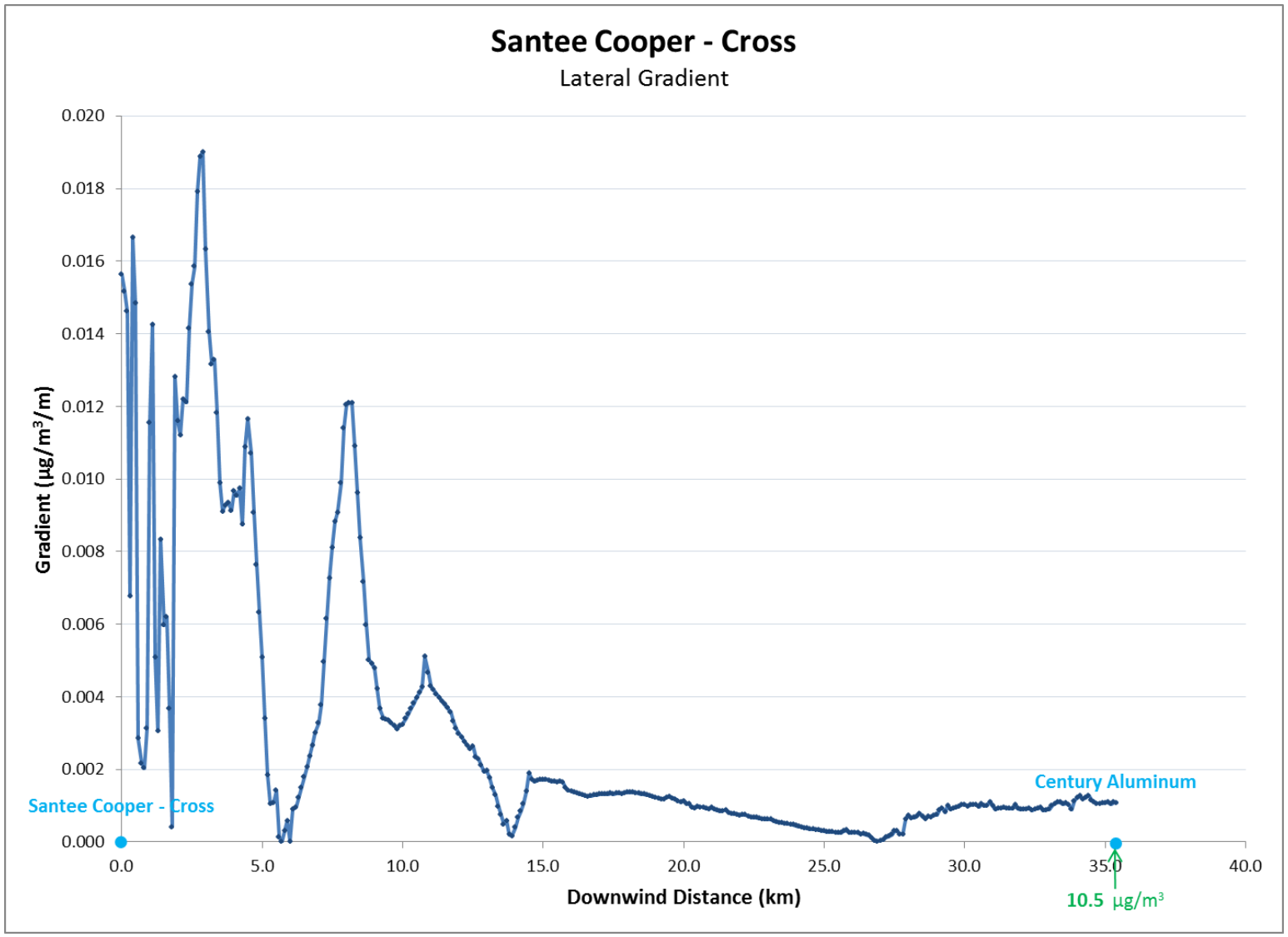

Figure 18 Lateral concentration gradient – Santee Cooper Cross

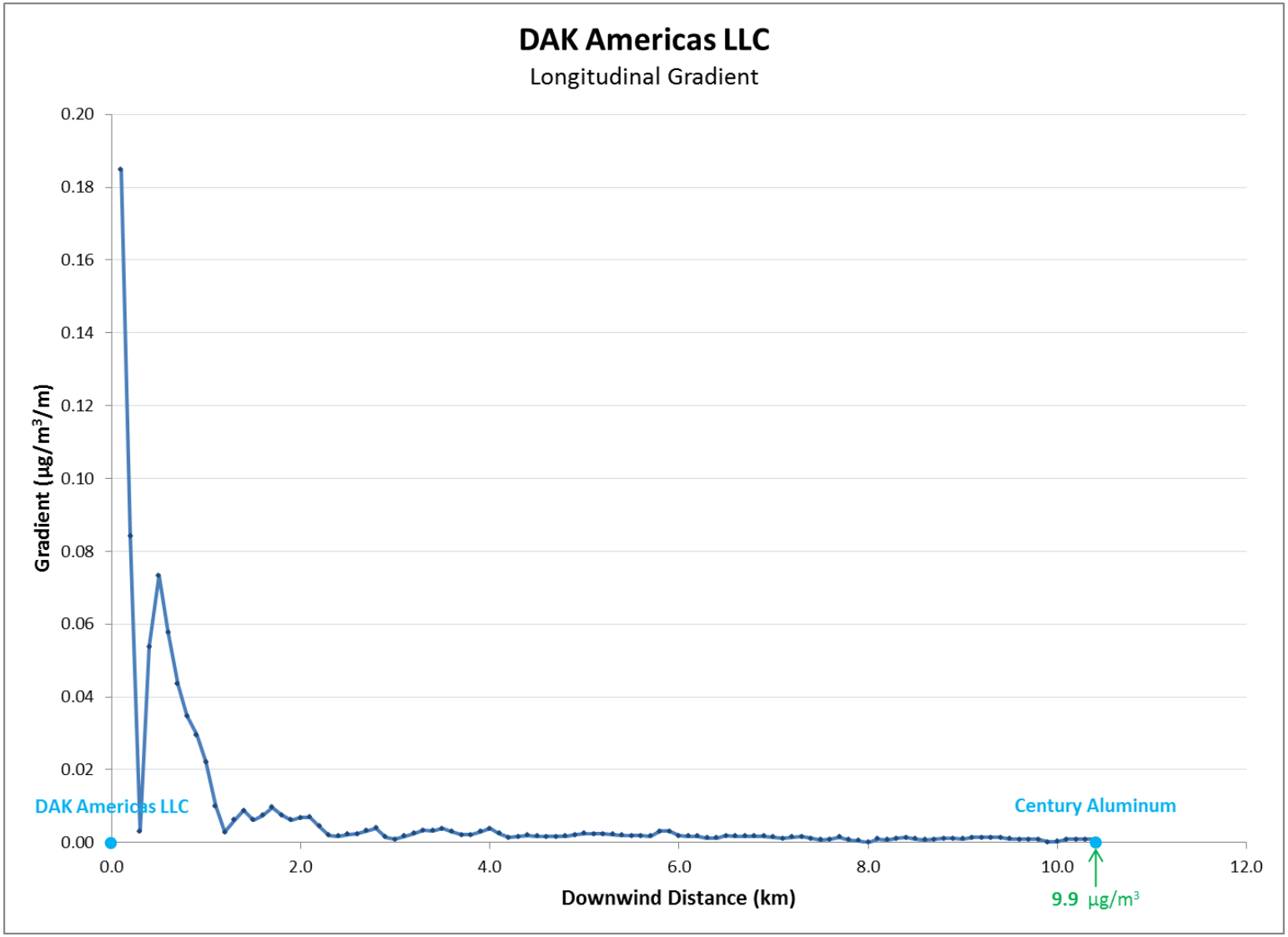

Figure 19 Longitudinal concentration gradient – DAK Americas

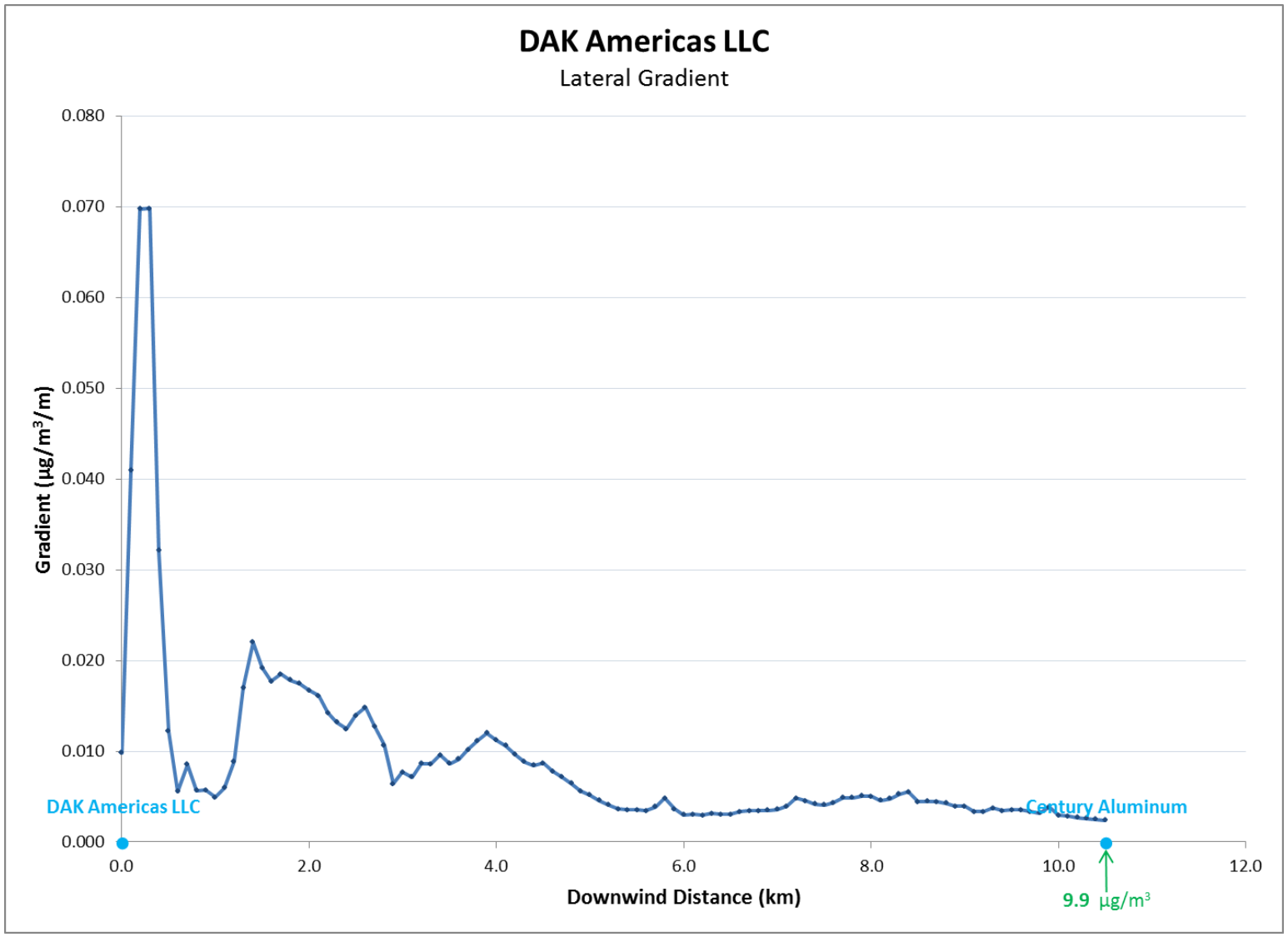

Figure 20 Lateral concentration gradient – DAK Americas

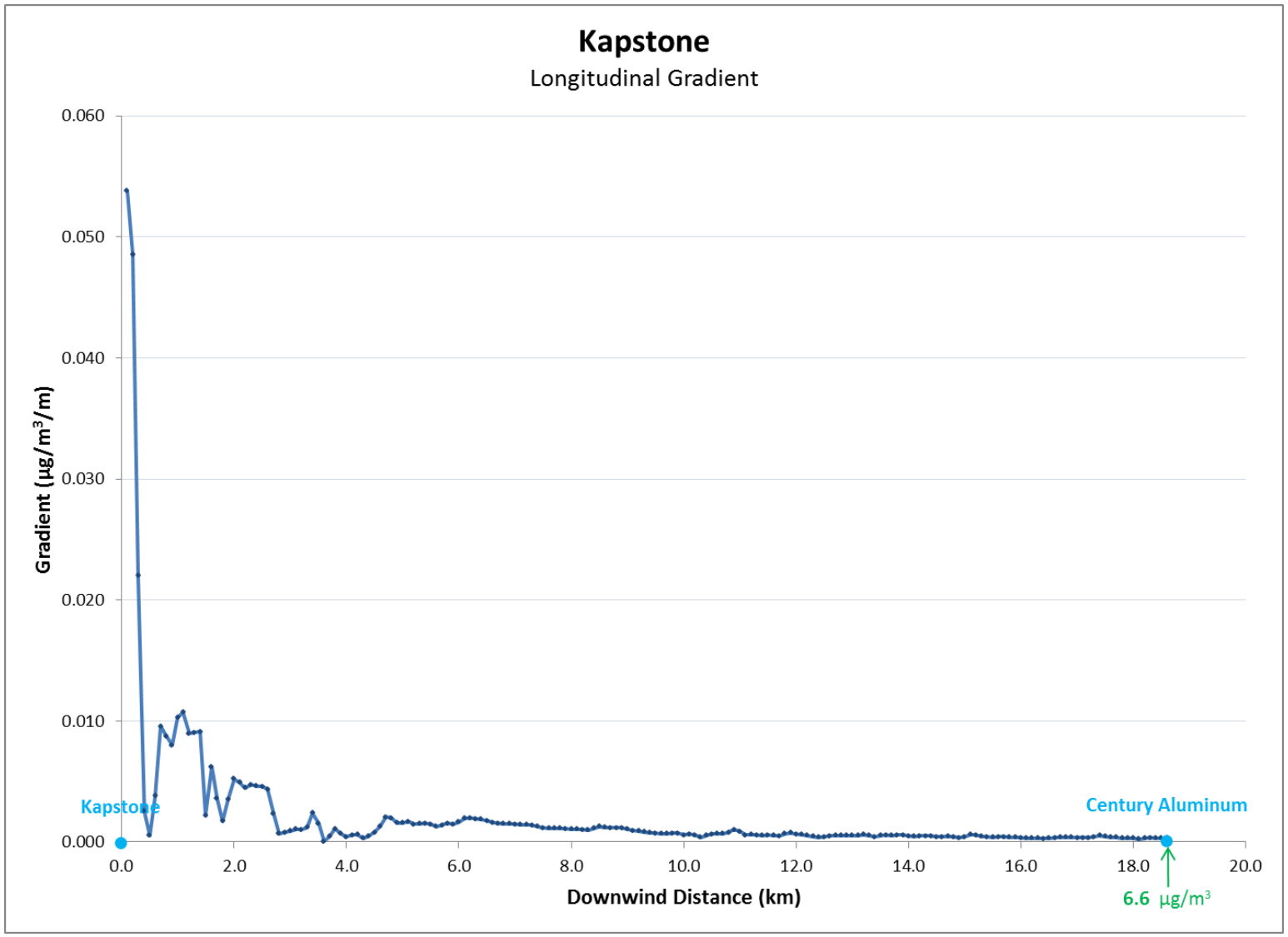

Figure 21 Longitudinal concentration gradient – Kapstone

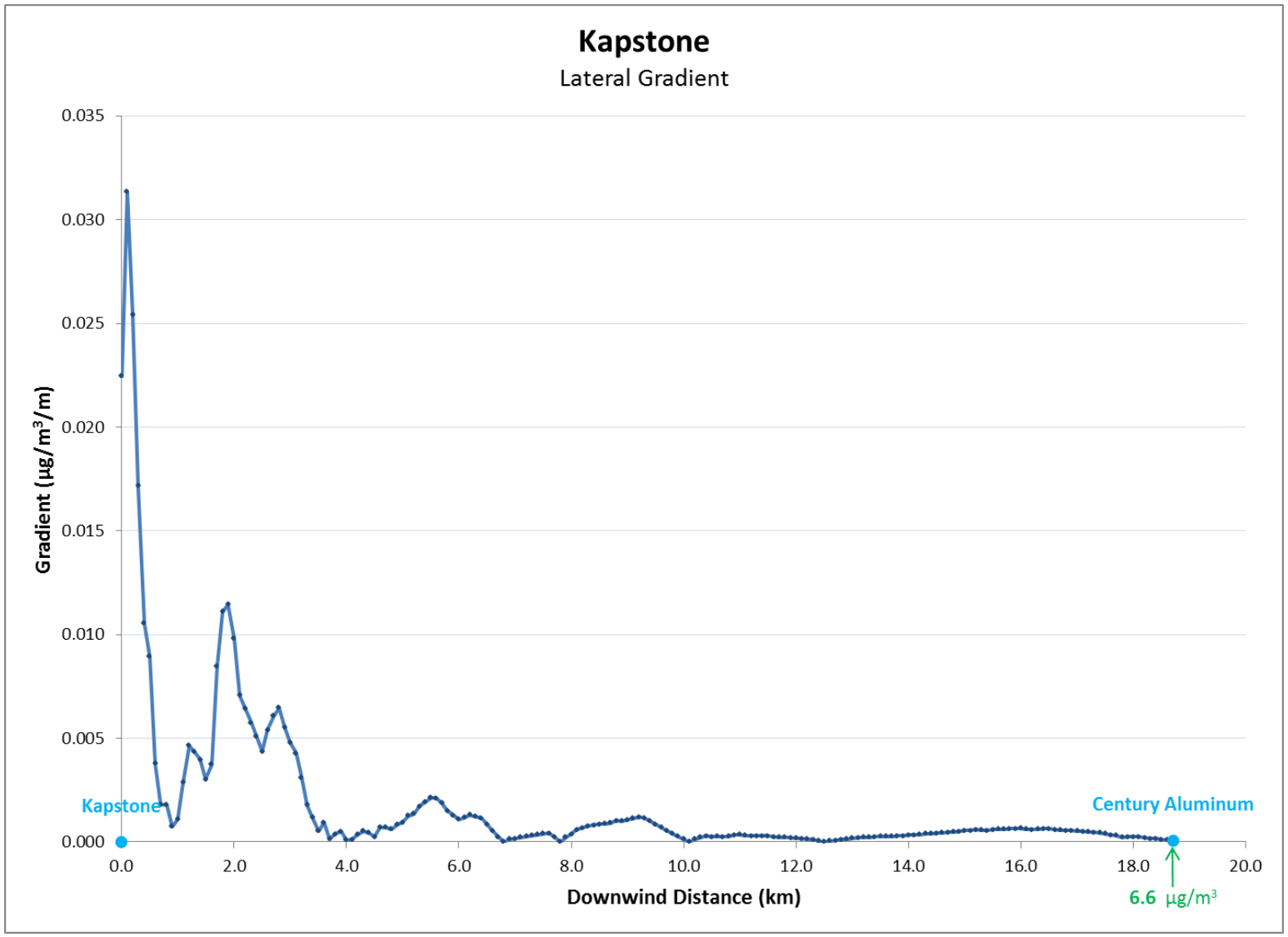

Figure 22 Lateral concentration gradient – Kapstone

3.2 Receptor Grid

A Cartesian (rectangular) receptor network was used for the cumulative impact analysis for attainment area designation purposes. The network, described below, includes a series of nested grids roughly centered on the Century facility.

An inner grid of 6,181 receptors with a spacing of 100m extends outward from the facility boundary to a distance of approximately 1 km and covers an area of approximately 9 km x 9 km. An intermediate grid of 3,392 receptors with a spacing of 250m extends from the outer edge of the 100m spaced receptor grid out to a distance of approximately 5 km from the facility, and the outer boundary covers an area of approximately 17 km x 17 km. An outer grid of 1,800 receptors with a spacing of 500m extends from the outer edge of the 250m spaced receptor grid out to a distance of approximately 10 km from the facility, and the outer boundary covers an area of approximately 27 km x 27 km. Receptors within the Century facility property boundary were excluded.

Additionally, 1,171 receptors at a spacing of no greater than 25m were placed along the Century facility property line. The property line is defined in a manner consistent with prior modeling analyses that have been submitted to DHEC BAQ and represents a fence that precludes public access to the areas enclosed within.

The resulting total number of grid receptors is 12,544. A plot of the receptor grid is shown in Figure 23. The receptor resolution used in the modeling meets or exceeds that recommended in DHEC BAQ guidance and in the TAD.

Receptors were also placed at the locations of the nearest ambient SO_2 monitors (Jenkins Avenue Fire Station and Cape Romain).

Guidance in Section 4.2 of the TAD indicates that receptors are not required in areas, such as water bodies, where placement of a monitor would not be feasible. To be conservative, receptors in such areas were not excluded.

The AERMAP preprocessor (Version 11103) was used to obtain receptor elevations and hill heights for the receptors modeled in AERMOD. AERMAP was run with 30 meter National Elevation Dataset (NED) Digital Elevation Model (DEM) GeoTIFF format files obtained from the U.S. Geological Survey (USGS).

The modeling uses a Universal Transverse Mercator (UTM) coordinate system. Coordinates are in Zone 17N and the datum is NAD83.

The receptor grid was sized such that there are no predicted SO_2 concentrations near or above the NAAQS at any receptors near the edge of the grid. Where predicted concentrations, including background concentrations, are within 10% of the standard, the receptor spacing is no greater than100m.

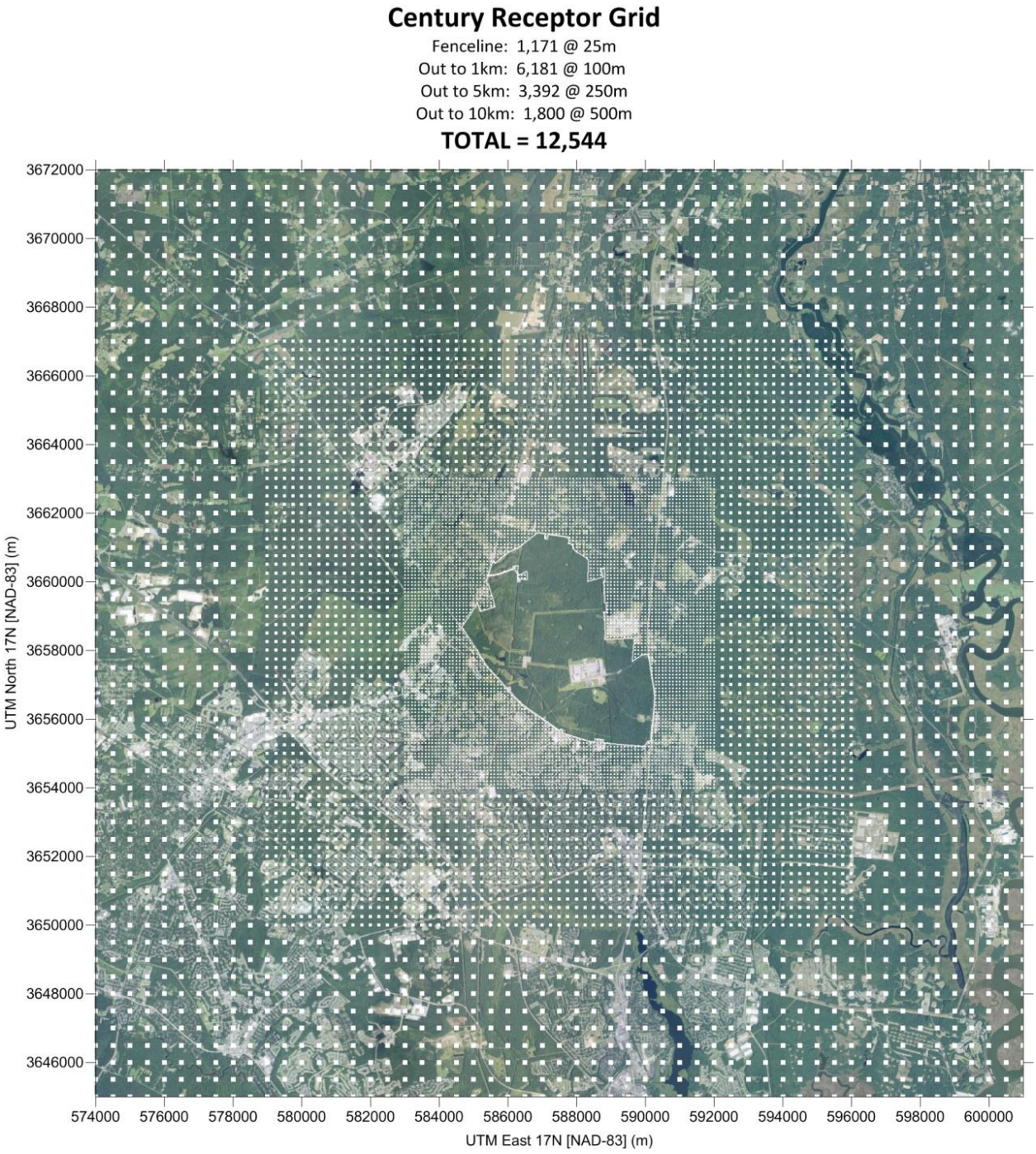

Figure 23 Plot of Cartesian and property line receptors

4 Emission Rates and Source Characterization

4.1 Century Source Data

Table 10 and Table 11 provide the SO_2 emission rates and source parameters used for modeling Century. Century was modeled using maximum allowable emissions and corresponding stack parameters. Consistent with Section 6.1 of the TAD, GEP stack height policy was followed.

Table 10 Century Point Source SO_2 Emission Rates and Parameters

Stack ID	SO_2 Emission Rate (lb/hr)	SO_2 Emission Rate (g/s)	Stack Height (m)	Exit Velocity (m/s)	Stack Diameter (m)	Stack Temperature (K)
83	0.003	0.0004	6.10	0.001*	0.61	366.00
84	0.001	0.0001	6.10	0.001*	0.30	366.00
85	1.270	0.1600	48.46	19.51	1.07	322.00
01	82.92	10.4479	61.26	26.47	1.43	353.10
02	212.24	26.7422	60.96	23.47	3.20	353.20
03	212.24	26.7422	60.96	23.47	3.20	353.20
04	212.24	26.7422	60.96	23.47	3.20	353.20
05	212.24	26.7422	60.96	23.47	3.20	353.20
51-103	0.009	0.0011	20.42	12.19	0.91	533.20
51-104	0.009	0.0011	20.42	12.19	0.91	533.20
51-105	0.009	0.0011	20.42	12.19	0.91	533.20
51-106	0.009	0.0011	20.42	12.19	0.91	533.20
51-107	0.009	0.0011	20.42	12.19	0.91	533.20
51-109	0.009	0.0011	20.42	12.19	0.91	533.20
51-110	0.009	0.0011	20.42	12.19	0.91	533.20
51-111	0.009	0.0011	20.42	12.19	0.91	533.20
51-112	0.009	0.0011	20.42	12.19	0.91	533.20
52-1	0.011	0.0014	17.37	6.19	0.61	366.50
52-2	0.011	0.0014	17.37	6.19	0.61	366.50
52-3	0.021	0.0026	17.37	6.19	1.22	366.50
122	0.002	0.0003	20.42	5.07	0.61	366.50

* Stacks 83 and 84 are capped with vertical releases and will be modeled with nominally low exit velocities of 0.001 m/s in accordance with guidance in Section 6.1 of the AERMOD Implementation Guide (AIG).

Table 11 Century Line Source SO_2 Emission Rates and Parameters

Stack ID	SO_2 Emission Rate (lb/hr)	SO_2 Emission Rate (g/s)	Release Height (m)	Building Length/ Height/ Width (m)	Monitor Width (m)	Buoyancy Parameter (m^4/s^3)
64	0.013	0.0016	17.7	213.36/ 16.7/ 50.25	0.91	10.3292

g =	9.81	m/s^2	- gravitational acceleration
L =	209	m	- monitor length
W_m =	0.91	m	- monitor width
w =	0.3	m/s	- exit velocity
T_s-T_a =	5.56	K	- ΔT = 15.7° C
T_s =	301.29	K	- exit temperature = 45.7° C
F' =	10.3292	m^4/s^3	- buoyancy parameter

$$F' = \frac{gLW_m w\left(T_s - T_a\right)}{T_s}$$

4.2 Urban vs. Rural Determination

The DHEC BAQ land use GIS tool was utilized to determine if the modeling should be conducted using rural or urban model algorithms based on the land use within a 3 km area surrounding Century. The DHEC BAQ land use GIS tool makes use of 2001 National Land Cover Database (NLCD) data and was applied for Century.

Table 12 shows the percent land use for different land use classes within 3 km of Century. A plot of the land use within 3 km of Century is shown in Figure 24. The area within 3 km of Century is predominately rural, with the non-developed land use categories accounting for total about 80% of the area. Consequently, the modeling analysis was conducted using the rural option in AERMOD.

Table 12 Land use percentage within 3 km of Century

Land use Class	Percentage of Total (%)
Open water	0.2%
Developed, Open Space	8.1%
Developed, Low Intensity	7.8%
Developed, Medium Intensity	2.2%
Developed, High Intensity	1.8%
Deciduous Forest	6.0%
Evergreen Forest	25.6%
Mixed Forest	2.9%
Scrub/Shrub	3.3%
Grassland/Herbaceous	4.3%
Pasture/Hay	3.5%
Cultivated Crops	1.7%
Woody Wetlands	32.5%
Emergent Herbaceous Wetland	0.1%

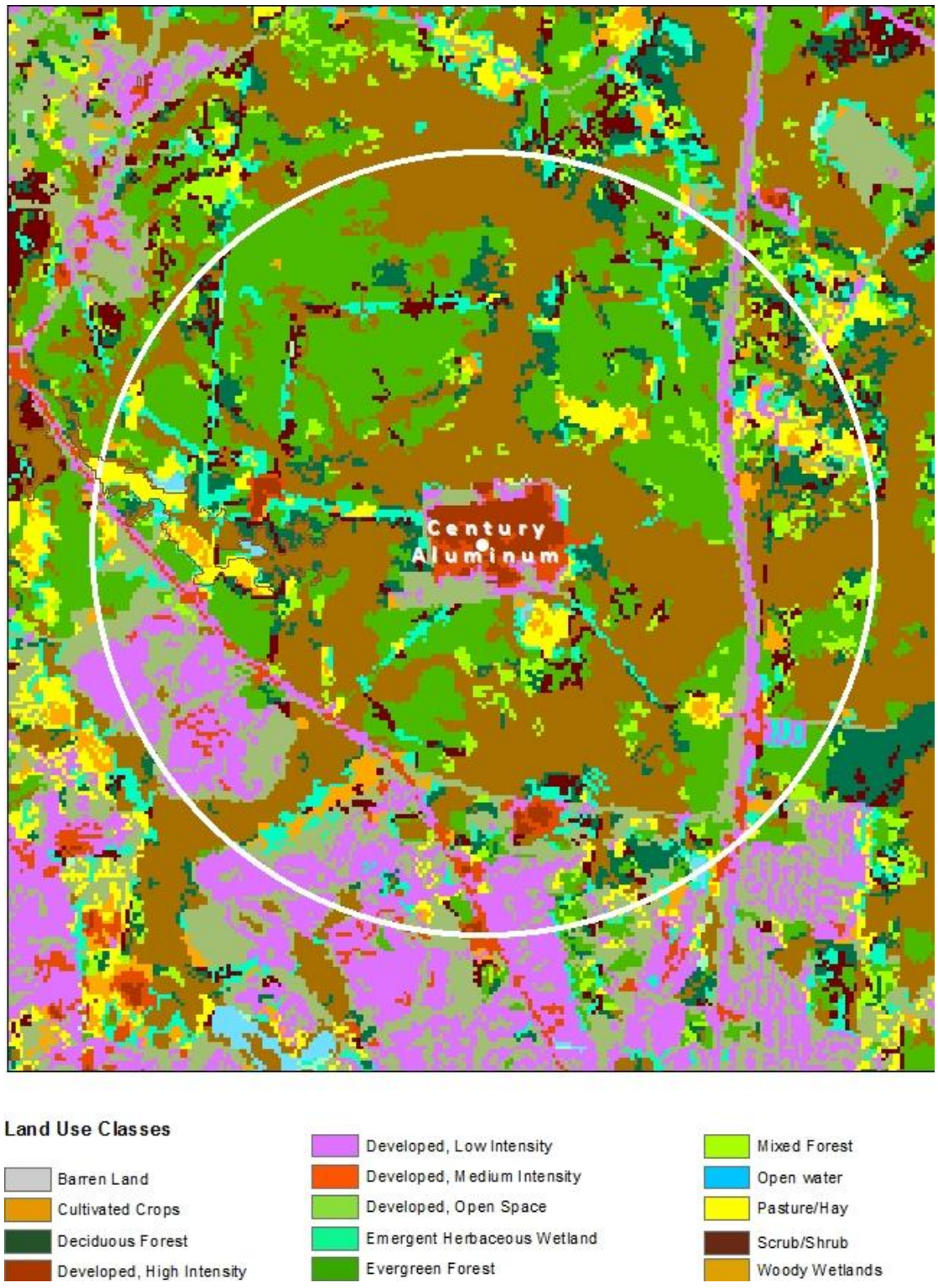

Figure 24 Plot of land use surrounding Century with 3 km radius circle

5 Meteorological Data

5.1 Overview

The modeling was performed utilizing the three most recent years of meteorological data, 2012 through 2014. DHEC BAQ provided the AERMOD-ready meteorological input files for this analysis based on the most representative station. AERMOD was run using the AERMET dataset run with current default options.

The Federal Aviation Administration (FAA) Surface Weather Observation Stations website[6] was used to help identify potential sources of hourly meteorological data for use in the modeling analysis. These include Automated Surface Observing System (ASOS) stations as well as Automated Weather Observing System (AWOS) stations. All airports with hourly surface weather observations within 50 km of Century were identified and are shown in Figure 25 along with circles of radius 20 km and 50 km centered on Century. These are:

- KCHS (Charleston International Airport),
- KMKS (Moncks Corner, also known as Berkeley County Airport),
- KDYB (Summerville),
- KLRO (Mount Pleasant), and
- KJZI (Johns Island, also known as Charleston Executive Airport).

[6] https://www.faa.gov/air_traffic/weather/asos/?state=SC

Figure 25 Airports with hourly meteorological data with 20 km and 50 km radius circles

In order to determine which meteorological data set was most suitable and representative for modeling, we examined several factors including proximity to Century, nature and complexity of terrain, exposure of site, period of record, representativeness of winds, surface characteristics, frequency of observation, and DHEC BAQ guidance and policy.

5.2 Proximity

Figure 25 shows the location of the candidate meteorological data sources relative to Century. The closest sites are KMKS and KCHS, both within 20 km of Century. KMKS, in Moncks Corner, is located about 15 km to the north, and KCHS, in Charleston, is located about 17 km to the south. KDYB, in Summerville, is located about 21 km to the west.

The two remaining sites are more distant. KLRO, in Mount Pleasant, is about 31 km east south-east relative to Century, while KJZI is located about 39 km to the south.

KMKS, KCHS, and KDYB are the closest sites to Century and would be expected to be more representative of the Century site based on proximity considerations.

5.3 Terrain Setting and Complexity

Neither Century nor any of the candidate meteorological sites has any significant nearby terrain features. The terrain in this part of South Carolina is characterized by flat terrain and small hills as shown in Figure 1. Complexity of terrain does not distinguish any of the candidate sites.

Proximity to the coast is a consideration given the occurrence of coastal effects such as land and sea breezes and fumigation. Century is located about 40 km from the coast. Two of the sources, KLRO and KJZI, are located considerably closer to the coast (9 km and 8 km, respectively) and are expected to experience more frequent and significant coastal effects compared to the Century site. The other three sites are located further inland relative to KLRO and KJZI. KCHS is located about 25 km from the coast, KMKS is located about 49 km from the coast, and KDYB is located about 53 km from the coast. Based on a consideration of

distance from the coast, KLRO and KJZI are expected to be less representative of the Century site.

5.4 Exposure of Measurement Site

All the candidate sites are either ASOS or AWOS sites and should meet instrument siting requirements. However, review of the instrument locations at each site shows that some sites are likely more exposed to local roughness elements associated with nearby buildings or terrain. These local roughness elements may affect the resulting distributions of wind speed and wind direction.

Figure 26 through Figure 30 show the region immediately surrounding the instrumented towers at the candidate meteorological sites. Each figure also shows a circle of radius 100m surrounding the instrumented tower. Figure 26 shows the area surrounding the anemometer site at KCHS. Figure 27 shows the area surrounding the anemometer site at KMKS. Figure 28 shows the area surrounding the anemometer site at KDYB. Figure 29 shows the area surrounding the anemometer site at KLRO. Figure 30 shows the area surrounding the anemometer site at KJZI.

The anemometer site at KCHS is unobstructed in the near-field. The anemometer site at KMKS is close to buildings located to the northeast and the west. The anemometer site at KDYB is near buildings on nearly all sides and is also not far from wooded areas to the west. The anemometer site at KLRO is near buildings located in the sector ranging from west counterclockwise to south and is also near wooded areas immediately to the east. The anemometer site at KJZI is relatively unobstructed. Based on a consideration of instrument exposure, KCHS and KJZI are likely to be least influenced by nearby structures, vegetation, and terrain.

Figure 26 Anemometer site at KCHS with 100m radius circle

Figure 27 Anemometer site at KMKS with 100m radius circle

Figure 28 Anemometer site at KDYB with 100m radius circle

Figure 29 Anemometer site at KLRO with 100m radius circle

Figure 30 Anemometer site at KJZI with 100m radius circle

5.5 Period of Record

The period of record of meteorological data used for the modeling analysis is 2012-2014. All candidate sites have data available for this 3-year period. Based on period of record, all candidate sites are equivalent.

5.6 Representativeness of Winds

In order to assess the representativeness of winds measured at the candidate meteorological station sites, wind roses for the proposed 3-year period 2012-2014 were obtained from the Wind Rose website maintained by the State Climate Office of North Carolina (see here: http://climate.ncsu.edu/windrose.php?state=SC&station=KJZI).

Figure 31 presents wind roses for the meteorological data sites under consideration based on data from 2012-2014. There are some similarities and differences among the wind direction distributions at the sites.

KCHS has predominant winds from the south-southwest and north-northeast with a pronounced secondary peak of winds from the west. KMKS has predominant winds from the north with fairly broad secondary peaks spanning the west-southwest through south directions and the north-northeast through northeast directions. KDYB has predominant winds from the north and south with a secondary peak from the west. KLRO has predominant winds from the north and south with a somewhat more uniform distribution for the other directions. KJZI has most frequent winds from the south-southwest, north, and south and also has fairly frequent winds from the east and west.

It is difficult to assert which site is most representative of the Century site based solely on wind direction distributions. The lack of significant differences suggests that wind direction would not be a significant factor in selecting a preferred site in this case.

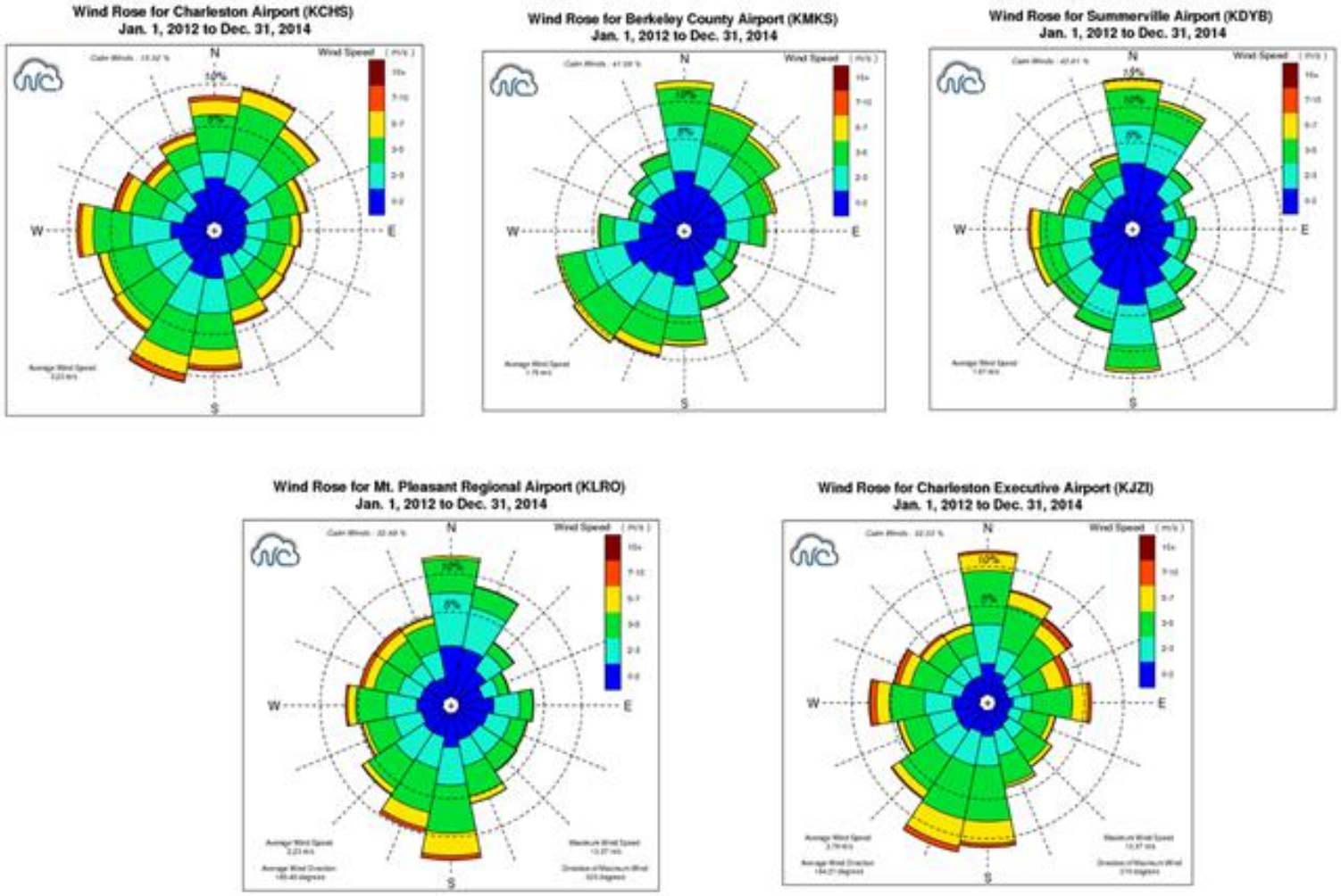

Figure 31 Wind roses for 2012-2014

The most noticeable differences among the sites become evident when wind speed is considered. Table 13 provides the average wind speed and the frequency of calms reported at each site based on observations from 2012-2014. The frequency of calm winds is unusually high at all sites except for KCHS. In addition, the average wind speed is very low at several of the sites, especially at KDYB and KMKS.

The high frequency of calms and the relatively low average wind speeds at most of the sites may be related to instrumentation, siting or exposure issues, or actual differences in conditions. However, as will be discussed in Section 5.8, frequency of observation is likely the cause for the high frequency of calms at all sites except for KCHS.

Table 13 Wind Speeds at Candidate Meteorological Data Sites

Meteorological Site	Average Wind Speed (m/s)	Frequency of Calms (%)
KCHS	3.23	15.3
KMKS	1.75	41.1
KDYB	1.67	40.6
KLRO	2.23	32.5
KJZI	2.78	32.0

5.7 Surface Characteristics

The TAD suggests considering various surface characteristics at the facility site and at the meteorological monitoring site in assessing representativeness of the meteorological data. AERMET, the AERMOD meteorological preprocessor, makes use of the following three surface characteristics for which values must be provided: surface roughness length (z_o), albedo and Bowen ratio.

EPA provides a tool called AERSURFACE to determine land use characteristics in accordance with guidance in the AIG based on digitized land cover data. AERSURFACE incorporates the use of look-up tables of representative surface characteristic values by land cover category and season.

The revised AIG provides the following recommendations for determining the site characteristics[7]:

1. The determination of the surface roughness length should be based on an inverse distance weighted geometric mean for a default upwind distance of 1 km relative to the measurement site. Surface roughness length may be varied by sector to account for variations in land cover near the measurement site, but sector widths should be no smaller than 30 degrees.

2. The determination of the Bowen ratio should be based on a simple unweighted geometric mean (i.e., no direction or distance dependency) for a representative domain, with a default domain defined by a 10 km by 10 km region centered on the measurement site.

3. The determination of the albedo should be based on a simple unweighted arithmetic mean (i.e., no direction or distance dependency) for the same representative domain as

[7] U.S. EPA (2015) p.6,7

defined for Bowen ratio, with a default domain defined by a 10 km by 10 km region centered on the measurement site.

The current version of AERSURFACE (Version 13016) supports the use of land cover data from the USGS National Land Cover Data 1992 archives (NLCD92). The NLCD92 archive provides data at a spatial resolution of 30 meters based upon a 21-category classification scheme applied over the continental U.S.

AERSURFACE was run for a location in the middle of the Century facility and also for locations corresponding to the instrumented meteorological tower at each candidate meteorological data site. AERSURFACE was run using the default domains. NLCD92 data for an area including and surrounding the sites of interest were downloaded as seamless data in GeoTIFF format from the Multi-Resolution Land Characteristics (MRLC) Consortium from a link at their website (http://www.mrlc.gov/viewerjs/). For determining surface roughness length, a single sector within 1 km was used along with the assumption of average moisture conditions and the default classification of seasons.

Table 14 provides the resulting values of surface parameters calculated by AERSURFACE for the Century site and candidate meteorological data sites.

Table 14 Calculated Surface Parameters for Century and Nearby Airports

	Annual Average Land Use		
Site	Albedo	Bowen Ratio	z_o
Century	0.15	0.61	0.147
KCHS	0.16	0.72	0.032
KMKS	0.14	0.47	0.375
KDYB	0.15	0.49	0.126
KLRO	0.13	0.35	0.297
KJZI	0.14	0.34	0.149

The albedo values at all sites are similar. The Bowen ratios vary somewhat over the various sites, with KCHS being the closest match. The Bowen ratios at KLRO and KHZI are substantially smaller than the value at Century. The surface roughness lengths also vary widely. Our experience is that surface roughness lengths at airports with well-sited anemometers are typically much smaller than those at large industrial facilities characterized by large buildings, tanks, and other structures. This explains the smaller z_o value at KCHS. Based solely on surface characteristics, KDYB is probably most representative of conditions at Century. However, as discussed in Section 5.4, the exposure of the meteorological monitoring instruments at KDYB is less than ideal.

5.8 Frequency of Wind Observations

EPA has identified the high rate of calm and variable winds at older ASOS stations and at AWOS stations as a potential problem with the use of National Weather Service (NWS) data for dispersion modeling. The AERMOD model, as is the case with other steady-state Gaussian models, cannot predict concentrations during hours with calm winds. Instead, it treats them as missing hours in accordance with longstanding EPA modeling guidance.

Meteorological observations collected by the NWS and by FAA have traditionally been taken near the top of the hour and reported as hourly averages. However, in recent years, many ASOS stations have begun to collect and archive 2-minute running average wind observations at 1-minute intervals. EPA developed a pre-processor, called AERMINUTE, which can process the 1-minute ASOS wind observations and generate hourly average winds for use in AERMET. Use of AERMINUTE is recommended by EPA when the 1-minute ASOS wind data are available and can significantly reduce the number of calm hours.

KCHS is an ASOS station and archives the 2-minute running average wind observations. The other candidate sites only report hourly wind data and have a high incidence of calms. KCHS has a smaller incidence of calms, and the use of AERMINUTE would be expected to further reduce the frequency of calms in the data set for KCHS. All other things being equal, the very high frequency of reported calms in the data sets other than KCHS leads to a general preference for the use of KCHS.

5.9 DHEC BAQ Recommendations and Guidance

DHEC BAQ guidance[8] recommends the following meteorological data sets for sources in Berkeley County[9]: surface meteorological data from Charleston International Airport (KCHS) along with concurrent upper air observations also from KCHS.

Century is located fairly close to the borders of Charleston County and Dorchester County. DHEC BAQ recommends use of the same meteorological data set in these counties as well.

5.10 Selection of Meteorological Data Set

DHEC BAQ clearly prefers and recommends the use of meteorological data from KCHS for modeling for sources in this part of South Carolina. Consideration of other factors most often suggested that data from KCHS would generally be most representative of conditions at Century.

For these reasons, meteorological data from KCHS were used in the modeling analysis.

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[8] http://www.scdhec.gov/Environment/AirQuality/ComplianceandReporting/AirDispersionModeling/ModelingData/

[9] http://www.scdhec.gov/Environment/docs/CHS_0206_v15181_Aug15.zip

6 Background Monitoring Data

6.1 Overview

Ambient air quality data are used to represent the contribution of sources that are not explicitly included in the modeling analysis. The effects of these small, distant, or natural sources are accounted for by determining and adding a background concentration to the predicted concentrations to yield an estimate of concentrations. In order to determine compliance with the 1-hour SO_2 NAAQS, the total predicted concentration, given by the sum of the modeled design concentration and the monitor design value (or other suitable estimate), is compared to the 1-hour SO_2 NAAQS to determine compliance.

There are two ambient SO_2 monitors located within 50 km of Century. Figure 32 shows the location of Century and the two closest SO_2 monitors:

- Jenkins Avenue Fire Station (Site ID: 45-019-003), and
- Cape Romain (Site ID: 45-019-0046).

The Jenkins Avenue Fire Station monitor is located about 20 km south south-east of Century. The Cape Romain monitor is located about 39 km east south-east of Century.

The design concentrations for the period of 2012 through 2014 are provided for the Jenkins Avenue Fire Station monitor in Table 15 and for the Cape Romain monitor in Table 16. The design concentration is based on the 99th percentile of the peak daily 1-hour SO_2 concentrations averaged over three years. Table 15 and Table 16 also provide the annual data capture rates for SO_2 at the respective monitors.

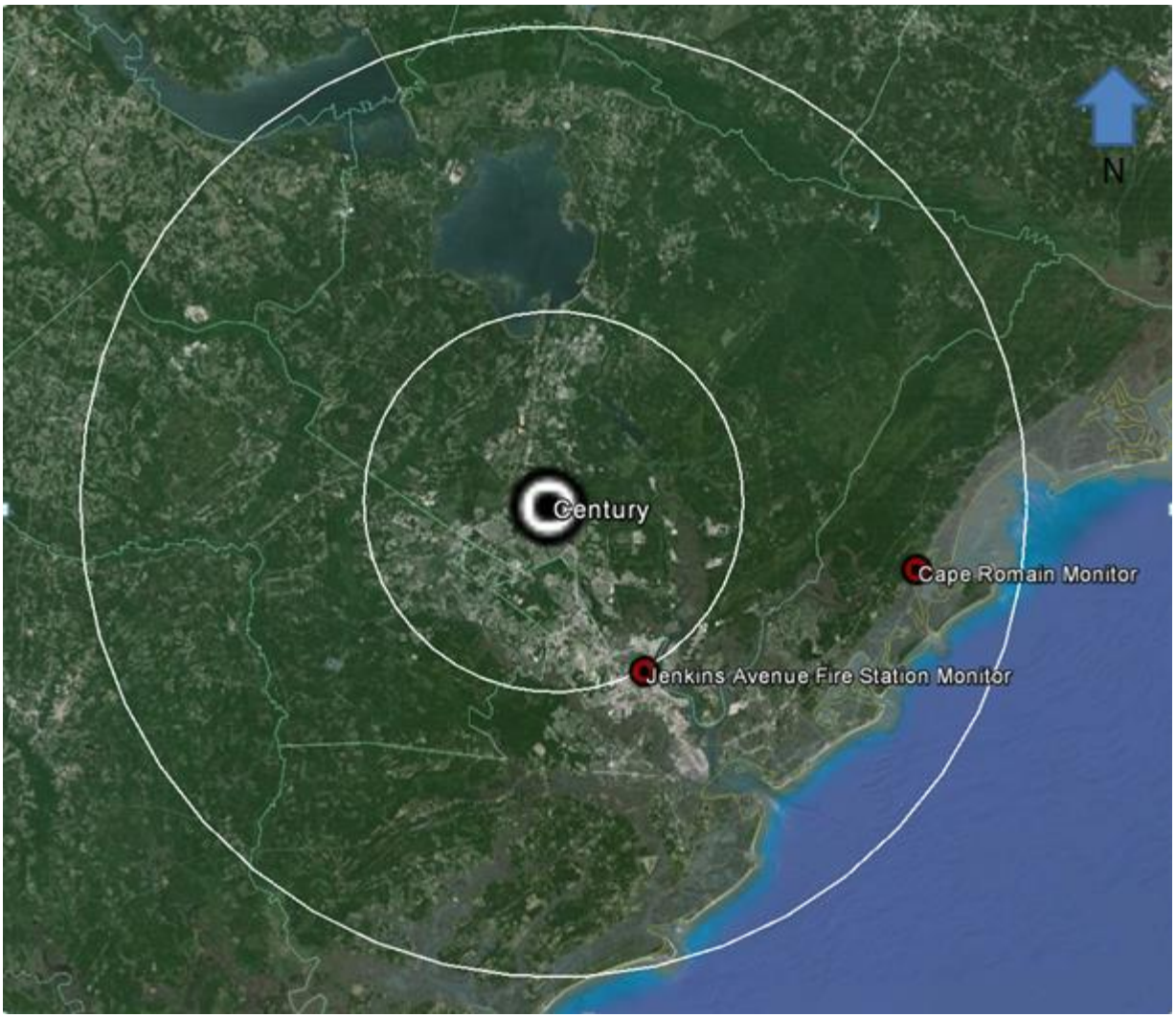

Figure 32 Nearest SO_2 monitoring sites with 20 km and 50 km circles

Table 15 1-hour SO_2 Design Concentrations for the Jenkins Avenue Fire Station Monitor

		Annual Data Capture		99th Percentile Concentration	Design Concentration (3-year average)	
Monitor	**Year**	hours	**%**	ppb	ppb	µg/m^3
Jenkins Avenue Fire Station	2012	8630	98.2	17		
	2013	8451	96.5	15	14.3	37.5
	2014	8691	99.2	11		

Table 16 1-hour SO_2 Design Concentrations for the Cape Romain Monitor

		Annual Data Capture		99th Percentile Concentration	Design Concentration (3-year average)	
Monitor	**Year**	hours	**%**	ppb	ppb	µg/m^3
Cape Romain	2012	8225	93.6	9		
	2013	8627	98.5	5	6	15.7
	2014	7274	83.0	4		

In order to determine the most representative ambient monitor to use for the ambient background concentration in the modeling analysis, several factors were considered, including proximity, data quality, and potential influence from nearby sources.

6.2 Proximity

As shown in Figure 32, the Jenkins Avenue Fire Station monitor is located approximately 20 km south-southeast of Century while the Cape Romain monitor is located approximately 39 km east-southeast of Century. Based solely on considerations of proximity, the Jenkins Avenue Fire Station monitor is expected to be more representative of background in the vicinity of Century.

6.3 Data Quality

Reference to Table 15 and Table 16 shows that the data capture rates at the Jenkins Avenue Fire Station monitor exceed those at the Cape Romain monitor. Data capture at the Jenkins Avenue Fire Station monitor exceeds 96% in all three years during the 2012-2014 period and averages 98% over the period. Data capture at the Cape Romain monitor is lower with a rate of only 83% in the most recent year and an average capture rate of 92% over the three year period.

Based on data quality considerations alone, data from the Jenkins Avenue Fire Station monitor is preferred.

6.4 Nearby Source Influence

Figure 33 shows the locations of the two candidate monitors along with locations of sources of SO_2 in the general area. Circles with a radius of 10 km are also shown centered on each monitor. The size and color of the icons representing nearby sources are described in the legend and are based on actual 2014 emissions. Facilities with actual SO_2 emissions less than 10 tpy in 2014 are not shown.

The Cape Romain monitor is located in a fairly remote area of the state and has no nearby SO_2 emission sources. In contrast, the Jenkins Avenue Fire Station monitor is located in an area with many nearby SO_2 sources, some of which may be included explicitly in the cumulative modeling analysis. Therefore, there is a potential for some double-counting of emissions if the Jenkins Avenue Fire Station monitor is used to represent background concentrations.

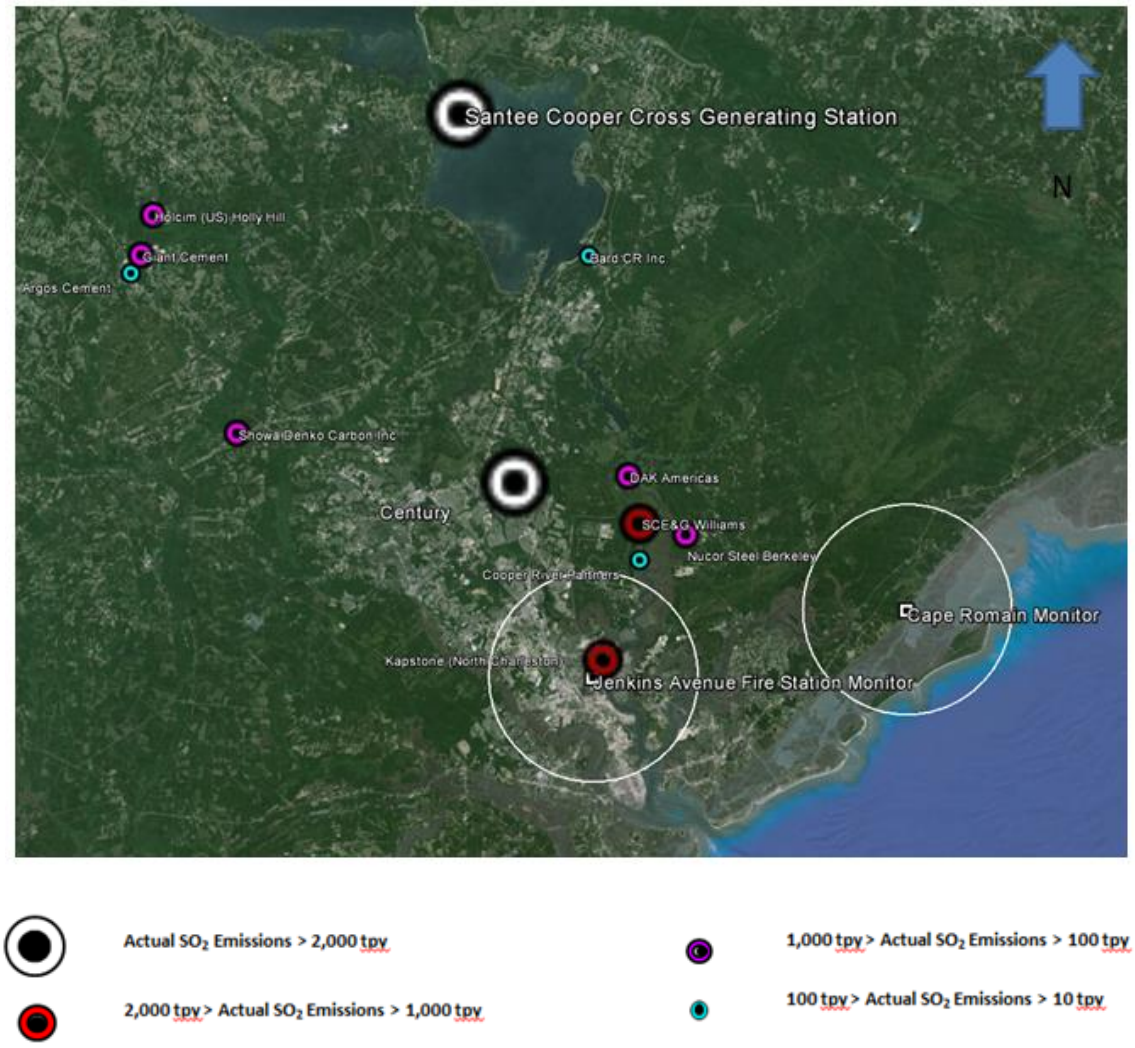

Figure 33 Nearest SO_2 monitors, nearby sources with emission rates greater than 10 TPY, and 10 km circles centered on monitors

6.5 Proposed Background Values

The Cape Romain monitor is located in an area that is largely unaffected by emissions from nearby sources. The Jenkins Avenue Fire Station monitor is located in an area with several nearby sources, some of which may also be included in the cumulative impact analysis. For this reason, values from the Cape Romain monitor are expected to be more representative of regional background values.

However, based on prior modeling analyses conducted by Exponent in this general area of the state, we are aware that DHEC BAQ and EPA believe that use of data from the Cape Romain monitor might result in an underestimate of total SO_2 concentrations in a cumulative modeling analysis. For this reason, we used data from the Jenkins Avenue Fire Station to characterize SO_2 background concentrations.

The 1-hour SO_2 design value concentration of 37.5 $\mu g/m^3$ based on 2012-2014 data from the Jenkins Avenue Fire Station monitor was added to the modeled design concentration to estimate the total impact.

7 Modeling Results

The three-year averaged, 4th high, maximum daily, one-hour SO_2 predicted total concentrations for Century are in compliance at all modeled receptors with the NAAQS value of 75 parts per billion (ppb) (approximately 196.0 µg/m^3). The controlling predicted three-year averaged, 4th high, maximum daily, one-hour SO_2 impact is shown below in Table 17.

Table 17 Controlling 3-year Average 4th-High Maximum Daily 1-hour SO_2 Predicted Concentration

Pollutant and Averaging Period	Century Contribution (µg/m^3)	Monitored Background Contribution (µg/m^3)	Total Concentration (µg/m^3)	NAAQS (µg/m^3)
SO_2 1-hour	107.5	37.5	145.0	196.0

8 Conclusion

The air quality modeling presented in this report demonstrates that the region surrounding Century in Goose Creek, South Carolina is in attainment with respect to the 1-hour NAAQS for SO_2. Therefore, the area should be classified as "attainment" with respect to the 1-hour NAAQS for SO_2.

9 References

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Appendix A

DAK Americas LLC

Actual SO_2 Monthly Emissions Reports

COOPER RIVER FACILITY 12-MONTH ROLLING SUM OF SO2 EMISSIONS TV-0420-0089

REPORTING PERIOD
START: January 1, 2014
END: March 31, 2014

Permit Condition 6.B.12
UNIT NO. 01 - 06
EQUIP. NO. P8A - P8F

DATE 4/28/2014

MONTH	SO2 EMISSIONS (TONS)	12-MONTH ROLLING SUM
Oct-11	50	615
Nov-11	50	617
Dec-11	50	604
Jan-12	63	605
Feb-12	63	615
Mar-12	60	627
Apr-12	50	622
May-12	51	631
Jun-12	45	632
Jul-12	35	615
Aug-12	41	606
Sep-12	45	604
Oct-12	52	606
Nov-12	58	614
Dec-12	57	621
Jan-13	49	607
Feb-13	42	586
Mar-13	53	579
Apr-13	46	575
May-13	47	570
Jun-13	45	570
Jul-13	44	579
Aug-13	44	582
Sep-13	39	576
Oct-13	54	579
Nov-13	59	579
Dec-13	60	583
Jan-14	76	610
Feb-14	51	618
Mar-14	61	626

COOPER RIVER FACILITY 12-MONTH ROLLING SUM OF SO2 EMISSIONS TV-0420-0089

REPORTING PERIOD
START: October 1, 2014
END: December 31, 2014

Permit Condition 6.B.12
UNIT NO. 01 - 06
EQUIP. NO. P8A - P8F

DATE 1/28/2015

MONTH	SO2 EMISSIONS (TONS)	12-MONTH ROLLING SUM
Jan-13	52	610
Feb-13	45	592
Mar-13	56	587
Apr-13	49	586
May-13	51	585
Jun-13	47	588
Jul-13	46	599
Aug-13	46	604
Sep-13	42	600
Oct-13	57	605
Nov-13	61	608
Dec-13	64	615
Jan-14	84	647
Feb-14	55	657
Mar-14	67	668
Apr-14	57	677
May-14	53	679
Jun-14	39	671
Jul-14	46	670
Aug-14	44	669
Sep-14	36	663
Oct-14	26	632
Nov-14	40	612
Dec-14	49	596