Appendix A
Dispersion Modeling Analysis for William H. Zimmer/Clermont County
2010 SO_2 NAAQS Recommended Designation

Introduction

The United States Environmental Protection Agency (U.S. EPA) established a new National Ambient Air Quality Standard (NAAQS) for SO_2 on June 22, 2010, of 75 ppb, as the 99th percentile of maximum daily values, averaged over three years. In addition, U.S. EPA revoked the primary annual and 24-hour standards.

On August 5, 2013 (75 FR 47191), effective October 4, 2013, U.S. EPA promulgated the initial SO_2 nonattainment areas for the newly established SO_2 standard across the country. On March 2, 2015, the U.S. District Court for the Northern District of California accepted as an enforceable order an agreement between the U.S. EPA and Sierra Club and the Natural Resources Defense Council to resolve litigation concerning the deadline for completing designations. The court's order directs U.S. EPA to complete designations in three steps: the first by July 2, 2016; the second by December 31, 2017 and the third by December 31, 2020. As part of the first round of designations, U.S. EPA has identified areas with newly monitored violations of the standard, or areas that contain stationary sources that emitted more than 16,000 tons of SO_2 in 2012 or emitted more than 2,600 tons of SO_2 and had an emission rate of at least 0.45 lbs SO_2/MMBtu in 2012. The U.S. EPA has identified two facilities in Ohio as meeting one or more of these criteria: the General James M. Gavin Plant and the W.H. Zimmer Generating Station.

This document supports the Ohio's recommended designation of the W.H. Zimmer Generating Station source area.

Per U.S. EPA's guidance (December 2013 *Draft SO_2 NAAQS Designations Modeling Technical Assistance Document* (herein referred to as "Modeling TAD")), "The primary objective of the modeling would be to determine whether an area currently meets the SO_2 NAAQS, and thereby indicate the designation process for the area". Ohio EPA is including this refined dispersion modeling analysis as a portion of the five-factor approach recommended by U.S. EPA in defining designation areas.

The dispersion modeling analysis was conducted for the 2012-2014 period, using actual hourly variable emissions from the William H. Zimmer facility. This was done per the Modeling TAD, in which U.S. EPA recommends modeling the most recent 3 years of actual emissions.

Temporally varying emissions were modeled to determine the contribution of emissions from each source in the modeling domain. Ohio EPA attempted to use variable emissions at the finest temporal scale available for each unit. Hourly variable emissions data for the 2012-2014 period were submitted to Ohio EPA by Dynegy Zimmer, LLC for all SO_2 sources at the William H. Zimmer facility. As described in Ohio's designation

modeling protocol (Appendix C of Ohio's recommended designation submittal), Part 75 emissions reporting data was used for the majority of hourly emissions, with data substitutions for some hours, as described in the modeling protocol.

Modeling Approach

Per U.S. EPA's Modeling TAD,

> "Since the purpose here pertains to designations, this guidance supports analyses of existing air quality rather than analyses of emissions limits necessary to provide for attainment. Consequently, the guidance in this TAD differs in selected respects from the guidance published in Appendix W. These differences include:
>
> - Placement of receptors only in areas where it is feasible to place a monitor vs. all ambient air locations (NSR, PSD, and SIP)
> - Use of the most recent 3 years of actual emissions (designations) vs. maximum allowable emissions (NSR, PSD, and SIP)
> - Use of 3 years of meteorological data (designations) vs. one to five years (NSR, PSD, and SIP)
> - Use of actual stack height for designations using actual emissions vs. Good Engineering Practice (GEP) stack height for other regulatory applications (NSR, PSD, and SIP)"

Ohio EPA incorporated the differences listed above and followed Appendix W guidance where applicable to modeling for designation purposes. The averaging period for the 2010 SO_2 NAAQS is the 99th percentile of maximum monitored daily values, averaged over three years. Per the Modeling TAD, three years of National Weather Service data is sufficient to allow the modeling to simulate a monitor. Thus, the modeled form of the standard is expressed as the 99th percentile of maximum daily values averaged over three years (herein referred to as "design value") for the purposes of designation.

The recommended dispersion model for modeling for SO_2 designations is the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) modeling system. There are two input data processors that are regulatory components of the AERMOD modeling system: AERMET, a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP, a terrain data preprocessor that incorporates complex terrain using United States Geological Survey (USGS) Digital Elevation Data. Additionally, Ohio EPA utilized the AERMINUTE module to incorporate 1-minute ASOS meteorological data into the hourly surface input file. Ohio EPA utilized the most up-to-date versions of AERMOD and the associated preprocessors available at the time of the attainment modeling analyses. These are as follows: AERMOD version 14134, AERMET version 14134, AERMINUTE version 14337, and AERMAP version 11103. All dispersion modeling for this submittal was conducted following Ohio EPA's designations modeling protocol.

Meteorological Data

In order to generate meteorological input data for use with AERMOD, AERMET, along with AERMINUTE and AERSURFACE preprocessing for the modeling domain was conducted to generate the surface (.sfc) and profile (.pfl). Ohio EPA used the AERMINUTE pre-processing module. This module accepts as input 1-minute ASOS meteorological surface observations, calculates an hourly average for each hour in the modeled time period, and substitutes any missing values from the co-located ISHD surface data. Use of AERMINUTE reduces the number of calm hours present in the input files, and these enhanced hourly files are therefore considered more representative of local meteorological conditions.

Meteorological data from 2012-2014 from the Cincinnati, OH surface station (Station # 93814) located at the Cincinnati/Northern Kentucky International Airport and the Wilmington, OH upper air station (Station # 13841) located at the Wilmington Airborne Airpark were used in these analyses. These sites were determined to be representative of Clermont County, OH and the surrounding region. AERSURFACE was run using twelve sectors and four seasons, centered on the location of the meteorological station.

Background

Ohio EPA applied background concentrations of SO_2 to all modeled results under all scenarios. Given the meteorology of the area and the known shutdown of the Walter C. Beckjord facility, Ohio EPA established a conservative background from ambient air quality data recorded at monitor 21-037-3002 from all hours, January 1, 2012 to February 28, 2015 for which the Walter C. Beckjord facility had zero emissions. From this data set, the 99th percentile of all non-zero hours, 11 ppb, was selected as the background. A full description of the background derivation is presented in Appendix B of Ohio's recommended designation submittal.

Emission Sources

The three SO_2 emission sources at the William H. Zimmer facility were included in the designation modeling analysis as two egress points, as the two auxiliary boilers share a common stack. Variable emissions for all sources were included in the model via the HOUREMIS input pathway, years 2012-2014. Ohio EPA utilized the 1-hour SO_2 design value output option internal to the AERMOD code to simplify post processing and eliminate the need to generate large hourly output files. Ohio EPA did not include background as a separate source in the model, but accounted for background by adding 11 ppb to all final model results. The relevant release point parameters for the emission units included in the analysis are presented in Table 1, below. All emissions sources included in the modeling were treated as point sources.

Ohio EPA, via outreach and consultation with the William H. Zimmer facility, identified erroneous emissions data resulting from faults in the continuous emissions monitors at the facility, Part 75 data substitutions, and other sources of erroneous emissions data. Missing periods were treated via a cubic spline interpolation across the 10 valid hours

before and 10 hours after. This interpolation was performed for 216 hours of emissions data in 2012, 3 hours in 2013, and 8 hours in 2014. These substitutions represent less than 1% of all hours in the designations modeling.

As part of the five factor analysis described in Ohio's recommended designation submittal, there were 83,038 TPY of actual SO_2 emissions in 2014 from Ohio and Kentucky sources within 50 kilometers of the border of Clermont County from facilities that might potentially need to be modeled under the requirements of the proposed Data Requirements Rule. 46,101 TPY of actual 2014 SO_2 emissions are within Clermont County itself. Of these large sources, Miami Fort Power Station Unit 6 ceased operations as of June 1, 2015, as described in Appendix H of Ohio's recommended designation submittal. Additionally, operations at the Walter C. Beckjord Station ceased as of June 1, 2015, as described in Appendices F and G of Ohio's recommended designation submittal. These shutdowns account for a reduction of 51,468 tons from 2014, or 62% from the area surrounding the William H. Zimmer facility. The remaining sources potentially needing to be modeled under the proposed Data Requirements Rule in Ohio; Miami Fort Power Station, located 57.1 kilometers distant from William H. Zimmer and DTE St. Bernard, LLC, located 41.6 kilometers distant from William H. Zimmer, were determined by Ohio EPA to be of sufficient distance from the source area to cause a significant concentration gradient. The same conclusion was reached for large sources located in Kentucky; Spurlock Station, located 40.9 kilometers distant, and Duke Energy Kentucky, East Bend, located 54.5 kilometers distant, are not expected to cause a significant concentration gradient in the source area that is not accounted for by background.

In addition to these larger sources which meet or exceed the Option 1 criteria of the proposed Data Requirements Rule, Ohio EPA also considered 2008 and 2014 emissions from Ohio sources within a 50 kilometer radius of the William H. Zimmer facility. These facilities are listed below with 2014 SO_2 emissions and shown in Figure 1:

Emery Oleochemicals, 1 ton

University of Cincinnati, 14 tons

Emerald Performance, 0.05 tons

Rock-Tenn Converting, 179 tons

Caraustar Mill, 0.1 tons

KAO Brands, 92 tons

Mill Creek WWTP, 20 tons

TSS Aviation, 10 tons

As shown in Figure 1, these facilities are located to the northwest of the William H. Zimmer source area.

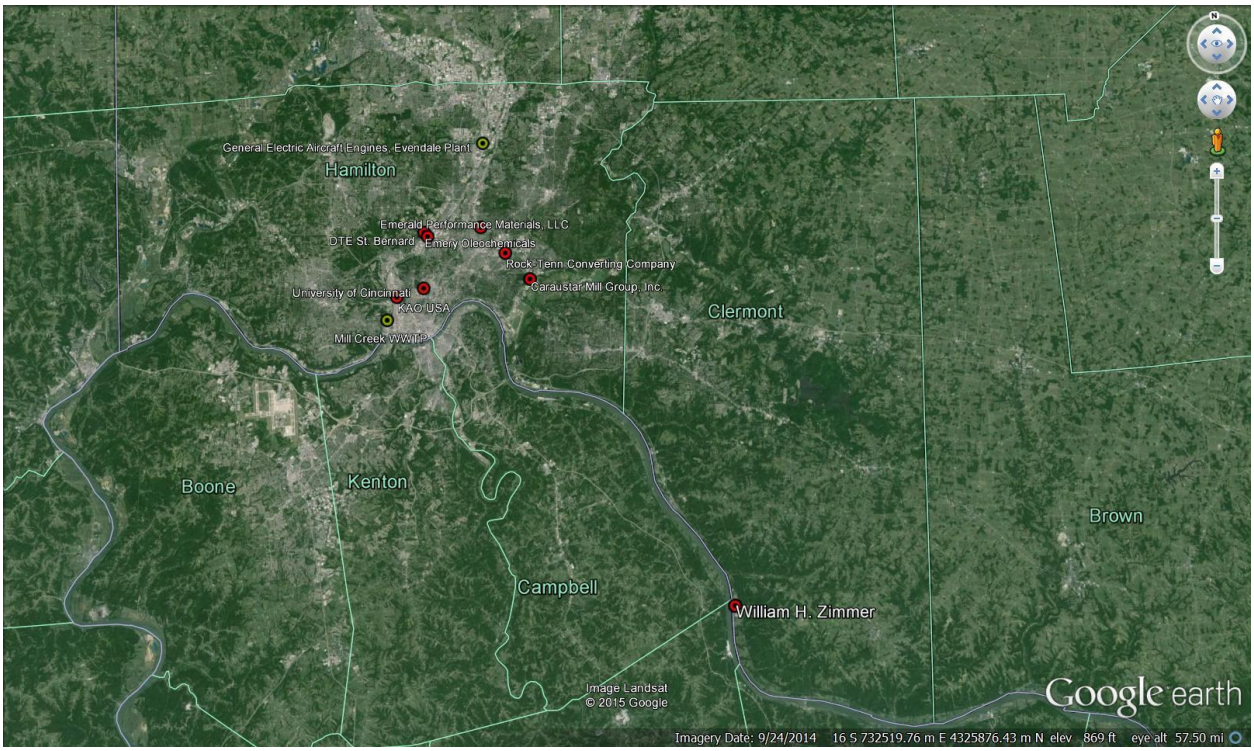

Figure 1: Nearby Ohio sources to William H. Zimmer, not meeting the proposed Data Requirements Rule.

Given the location and distance of these facilities from the William H. Zimmer facility and source area as well as their relatively low SO_2 emission levels, Ohio EPA has determined that these facilities are unlikely to cause a significant concentration gradient in the source area. Examination of a composite wind rose (Figure 2), years 2012-2014, from the Covington meteorological station would indicate that the predominant wind directions are unlikely to carry emissions from these sources to the William H. Zimmer source area.

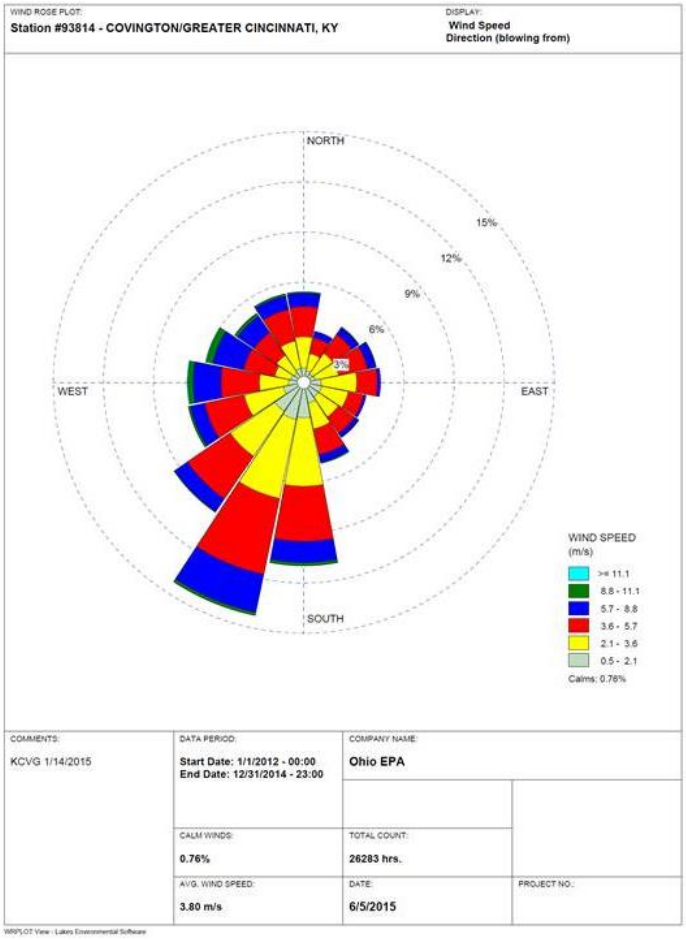

Figure 2: Covington wind rose, 2012-2014.

	Source ID	Source Description	Easting (X)	Northing (Y)	Base Elevation	Stack Height	Temperature	Exit Velocity	Stack Diameter	SO2
			(m)	(m)	(m)	(m)	(K)	(m/s)	(m)	(lb/hr)
William H. Zimmer	B006_ZM	Main Boiler Unit 1 Stack	740462.3	4305892	155.4	174	Variable	Variable	12.8	Variable
	AUX_AB	Aux. Boilers A and B Stack	740391.7	4305630	155.3	91	Variable	Variable	3.35	Variable

Table 1: Modeled source parameters, William H. Zimmer, 2012-2014.

Analysis

The designation modeling analysis consisted of a single modeling run, years 2012-2014. The results of this analysis are to be used to inform the designation process for the area surrounding the William H. Zimmer facility.

Receptors

A total of 37,702 receptors were included in the modeling domain. 50 meters spacing was used along the fenceline of the William H. Zimmer facility, and a 50 meters spacing to 3 km from the fenceline was used. The large, dense grid around the facility was informed by screen modeling to ensure that the point of maximum impact would be located within this dense grid. 100 meters spacing was used within 5 km of the fenceline, 250 meters spacing was used to 7 km from the fenceline, and a 500 meters spacing was used to 10 km from the fenceline. Beyond 10 km, a 1000 meters spacing was used to 25 km distant. Further, the northern-most portion of Clermont County, which was not covered by the grid described above, was populated with a 1000 meters spacing receptor grid. A discrete receptor was also included at the location of the monitor, 21-037-3002. Consistent with U.S. EPA's Modeling TAD, which states that in areas where placement of a monitor is not feasible, receptors can be ignored or not placed, receptors located in the Ohio River were eliminated from the receptor grid. Figure 2 shows the location of the facility as well as the receptor grid used. Also shown in Figure 1 is the border of Clermont County, OH (red), and the Campbell-Clermont, KY-OH nonattainment area (blue), for which Ohio EPA has submitted a separate redesignation request on August 11, 2015 based on monitored attainment, back trajectory analysis, and the closure of all SO_2 sources at the Walter C. Beckjord facility.

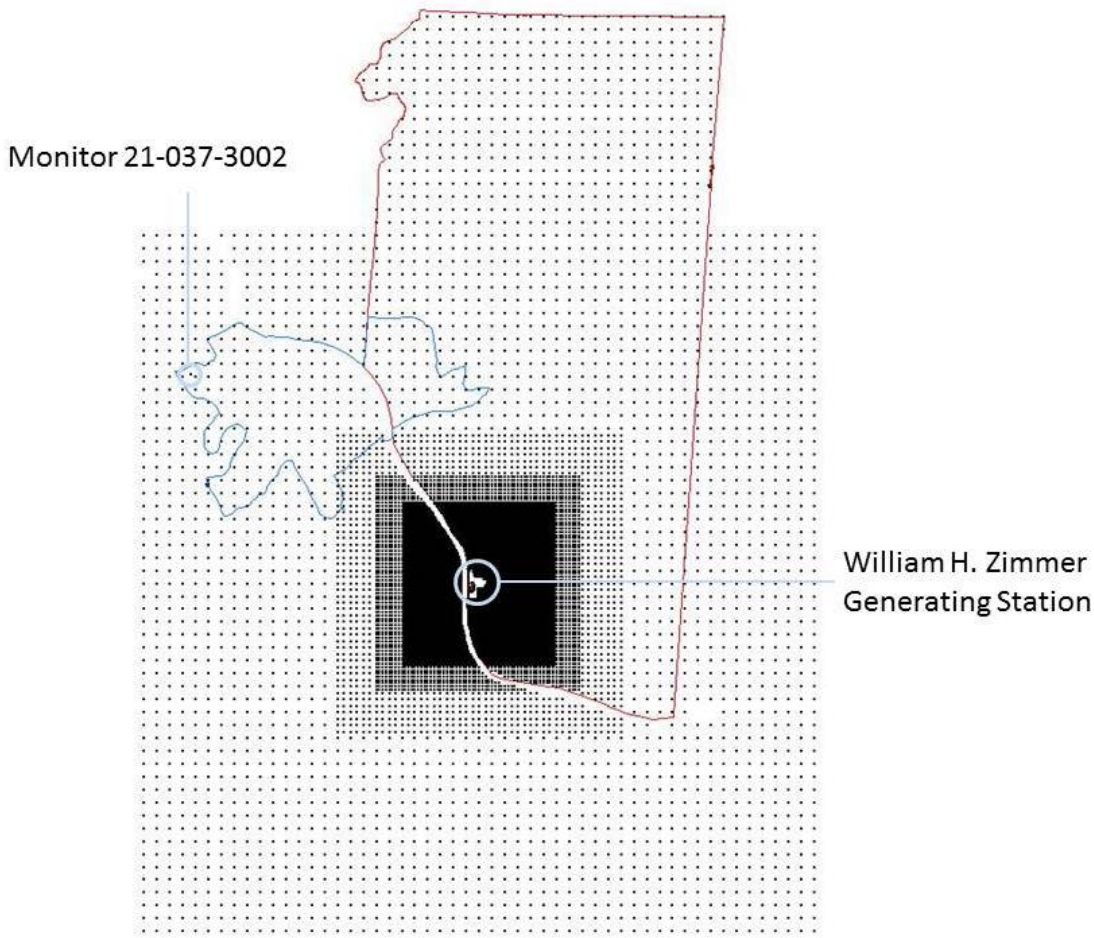

Figure 3: Receptor grid and William H. Zimmer facility.

Results

The dispersion modeling analysis evaluated the impact of the William H. Zimmer facility as a design value when modeled using hourly variable SO_2 emissions. Any maximum impact exceeding 167.4240 $\mu g/m^3$ would represent a modeled exceedance, considering a background concentration of 11 ppb (28.7760 $\mu g/m^3$). For this analysis, the maximum modeled 3-year design value, years 2012-2014, was 118.2265 $\mu g/m^3$. Thus, no exceedance of the standard was modeled. The results of this analysis are shown in Figure 4. Note that for clarity, only design values of 100 $\mu g/m^3$ or greater are displayed.

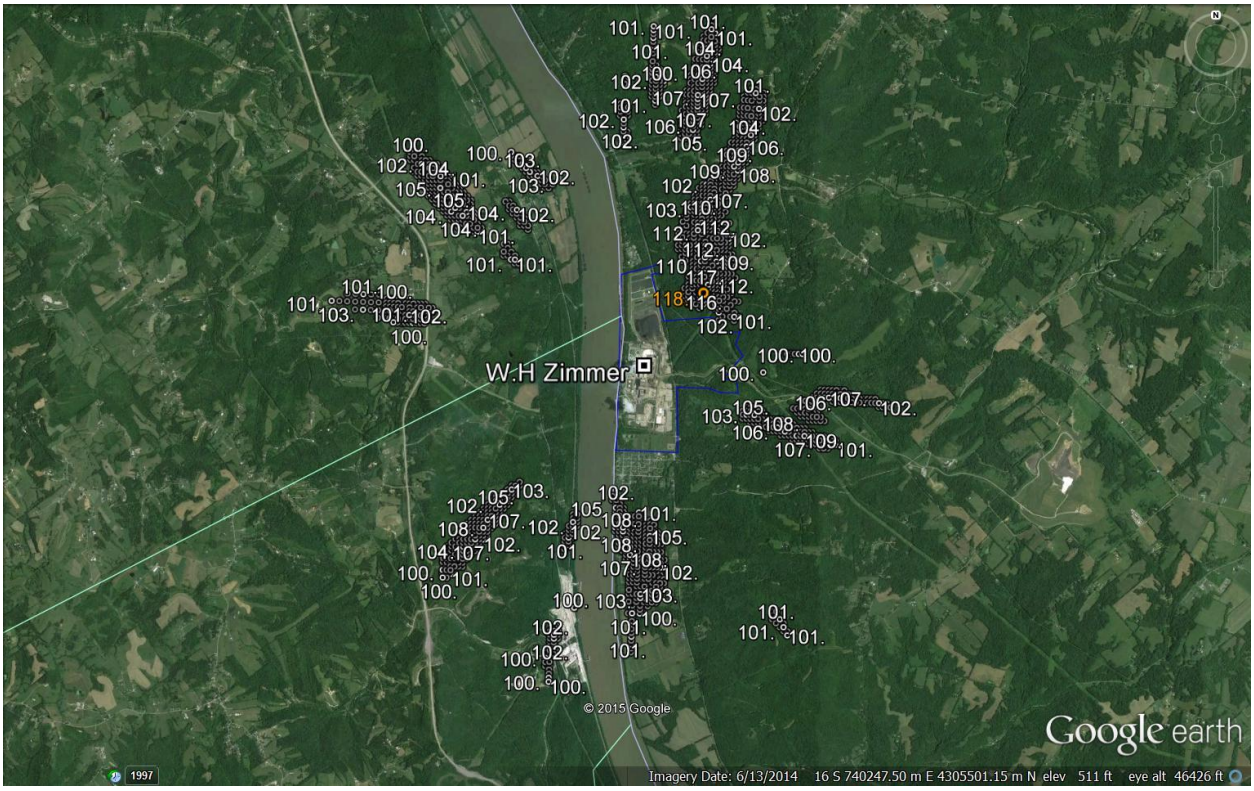

Figure 4: Maximum SO_2 impacts, William H. Zimmer facility, 2012-2014. Concentrations in $\mu g/m^3$.

The maximum modeled concentration, 118.2265 ug/m3, or 56.2 ppb including background, is located approximately 350 meters from the facility fenceline and approximately 1,200 meters from the main SO_2 source. The spatial distribution of modeled concentrations greater than 100 ug/m3 were located in a 4 to 5 km radius of the primary emissions source. Figure 5 presents the same receptor information as above, but shows also the border of Clermont County, OH and the adjacent Campbell-Clermont KY-OH nonattainment area.

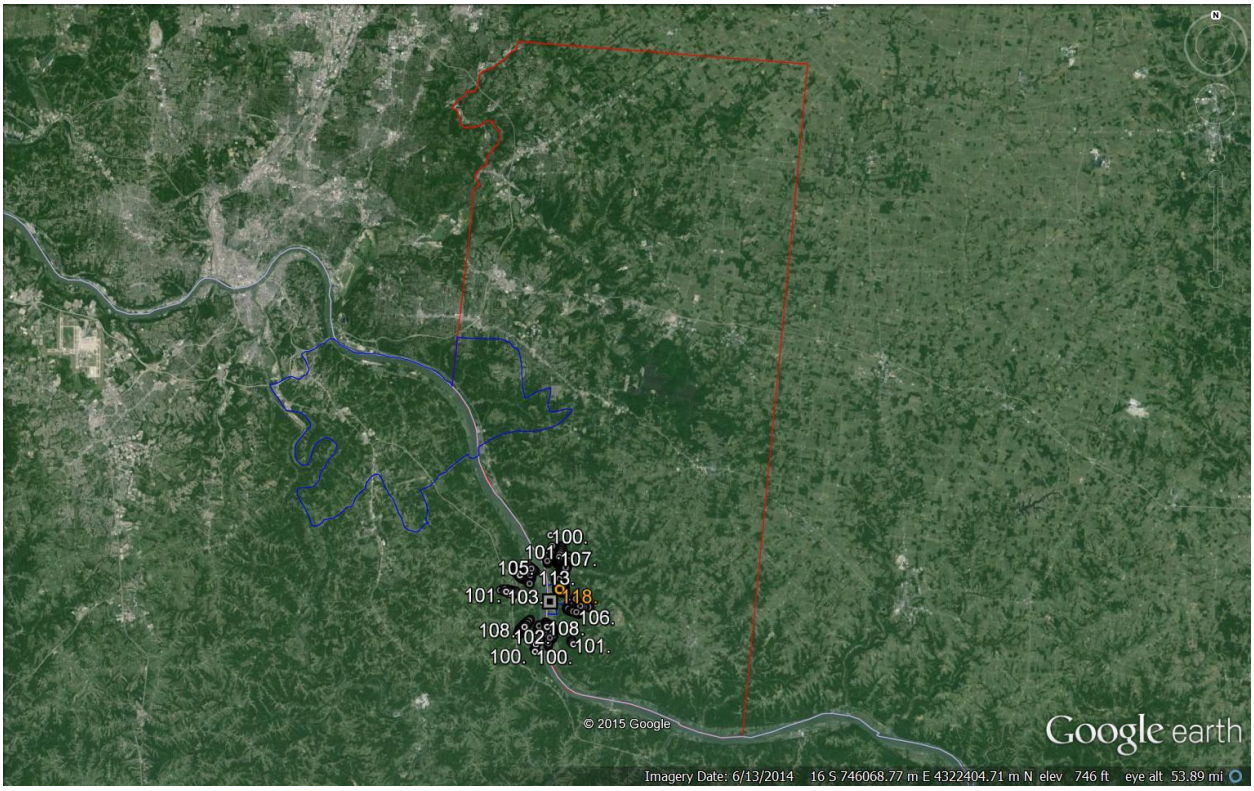

Figure 5: Maximum SO_2 impacts, William H. Zimmer facility, 2012-2014 and Clermont County borders. Concentrations shown in $\mu g/m^3$, background not included.

As can be seen in Figure 5, the majority of Clermont County (and the existing adjacent Campbell-Clermont, KY-OH nonattainment area) is not impacted by SO_2 emissions from the William H. Zimmer facility that would show modeled design values greater than 100 $\mu g/m^3$.

The dispersion modeling analysis for the designation of the area surrounding the William H. Zimmer facility demonstrates no modeled exceedances of the 2010 SO_2 standard based on the 2012-2014 period. Further, dispersion modeling performed with the AERMOD model accounts for multiple aspects of the five-factor analysis emphasized by U.S. EPA in designated areas. As such, Ohio EPA asserts that the modeling results presented here should carry significant weight in the designation process.