

Appendix B

William H. Zimmer Source Area Background SO₂ Analysis

Introduction

The United States Environmental Protection Agency (U.S. EPA) established a new National Ambient Air Quality Standard (NAAQS) for SO₂ 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 SO₂ nonattainment areas for the newly established SO₂ 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 to be completed by July 2, 2016. States are to submit recommended designations for these first round areas by September 18, 2015.

This document supports the modeling portion of Ohio's recommended designation for the William H. Zimmer source area. Ohio EPA performed an extensive analysis of meteorology, emissions and monitor data to derive a background SO₂ concentration representative of those sources not explicitly included in the modeling analysis. Ohio EPA conducted this analysis based on hourly SO₂ concentrations recorded at monitor 21-037-3002, wind direction data from the Cincinnati weather station located at the Cincinnati Northern Kentucky Airport (Covington), and emissions from both the Walter C. Beckjord and William H. Zimmer facilities for years 2012 through February 28, 2015. This time period is henceforth referred to as the study period.

Methodology

Hourly SO₂ emissions data from the Walter C. Beckjord and William H. Zimmer facilities were collected from the U.S. EPA Clean Air Markets Database for the study period. Hourly and one-minute wind data were collected from the National Weather Service station located at the Cincinnati Northern Kentucky Airport. To ensure that the most complete meteorological record possible was used, Ohio EPA processed the hourly meteorological data and one-minute ASOS data using the most recent versions of the AERMOD preprocessors AERMET and AERMINUTE. In addition to eliminating missing periods in the meteorological data, this processing provided hourly outputs that were more easily paired with hourly emission and monitor data. Hourly monitoring data for monitor 21-037-3002 were obtained from U.S. EPA's Air Quality System.

After compiling the above hourly data, Ohio EPA binned all data based on wind direction data, in ten degree increments. This was done for the entirety of the study period. The same binning of the data by wind direction was also done for only those periods in which the Walter C. Beckjord facility had zero SO₂ emissions. This yielded a substantial dataset of 10,231 hours of monitor data not impacted by emissions from the

Walter C. Beckjord facility that is more representative of future monitor values following the shutdown of the Walter C. Beckjord facility (Appendix F, Appendix G). It should be noted, however, that no accounting for any temporal overlap between any hour of zero emissions from the Walter C. Beckjord facility and monitor values was performed. Thus, it is likely that this dataset represents some impacts from Walter C. Beckjord at the monitor location. Ohio EPA believes that by not accounting for this overlap, any subsequent analysis of this dataset and the resultant background concentration will be conservative. Additionally, Ohio EPA made no attempt to eliminate periods when emissions from William H. Zimmer may impact the monitor, however minor those impacts may be. As such, there is likely some degree of double counting when the derived background is applied to modeled results.

Analysis and Results

To determine the primary wind directions in which monitored concentrations are elevated, Ohio EPA evaluated those bins for which either the first or second highest monitored value represented an exceedance of the standard. Further, Ohio EPA included in its evaluation any bin for which the sum of the first and second highest monitored values exceeded the average plus the sample standard deviation of this value across all bins. For the full study period, which includes impacts from the Walter C. Beckjord facility, Ohio EPA determined that winds originating from between 31° and 140° and from between 151° and 170° had the greatest impact on monitor concentrations. The results of this analysis are consistent with those presented by Ohio EPA in its back trajectory analysis in support of the redesignation of the Campbell-Clermont, KY-OH nonattainment area. The maximum concentration recorded at the monitor during the study period, 156 ppb, was the result of winds originating between 121° and 130°. This result is again consistent with prior analyses, and is attributed to emissions from the Walter C. Beckjord facility.

The same analysis described above was performed for the dataset compiled from hours in which emissions from the Walter C. Beckjord facility were zero to derive a representative background. It should be noted that this data set of 10,231 hours encompasses 1,445 hours of 2012, 2,542 hours of 2013, 4,828 hours of 2014, and 1,416 hours of 2015. Additionally, no exceedances of the standard were monitored during these hours, and the highest maximum hourly concentration recorded during these hours was 34 ppb. Using the same procedure as described above, Ohio EPA determined that for this dataset, winds originating between 211° and 220°, as well as those originating between 251° and 300° had the greatest impact on monitor concentrations. This represents a significant shift in impacting wind directions with respect to the results of the full study period. Further, these wind direction bins resulted in no exceedances at the monitor over the full 2012 to February 28, 2015 study period. Ohio EPA contends that this is strong evidence that derived background concentration is representative of impacts from sources located to the west and southwest of Clermont County.

Figure 1, below, shows the location of monitor 21-037-3002 and facilities within a 50 km radius with SO₂ emissions greater than or equal to 1,000 TPY in 2014.

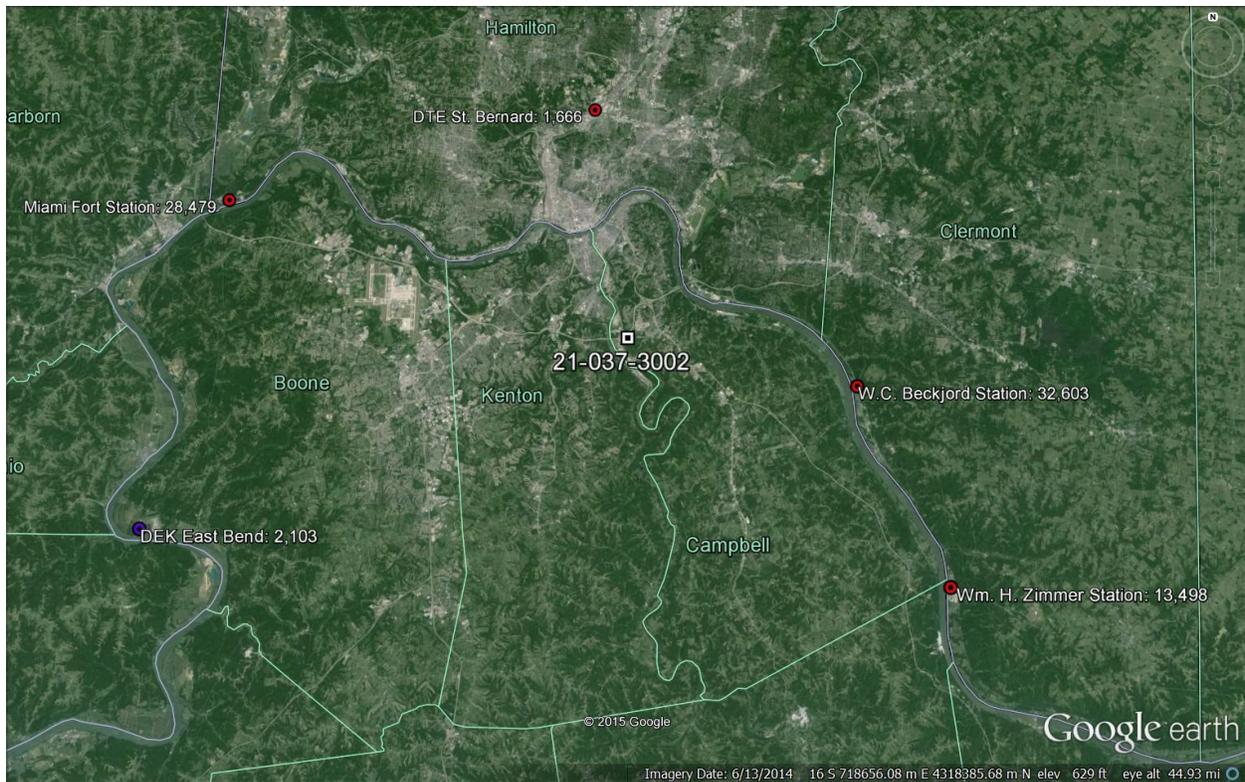


Figure 1: Monitor 21-037-3002 and surrounding SO₂ sources.

As stated above, Ohio EPA determined that for the dataset excluding periods when the Walter C. Beckjord facility was emitting SO₂, winds originating between 211° and 220°, as well as those originating between 251° and 300° had the greatest impact on monitor concentrations. Figure 1 above suggests that these wind directions would bring emissions from the Miami Fort Station, 30.3 km away from the monitor, and from the Duke Energy Kentucky East Bend facility, located 35.3 km distant from the monitor. Given these large distances, Ohio EPA believes that the impact of these facilities will be relatively uniform across the nonattainment area. Dispersion screening tests would suggest that over this distance, there would be an approximately 86% decrease from the point of maximum concentration, located within approximately 1 km of the facility, to a point 30 km distant, and an 89% decrease at 40 km. This indicates that there is little concentration gradient across the source area associated with sources located 30 to 35 km distant. Ohio EPA understands reductions in SO₂ emissions from those facilities potentially impacting have occurred since June 1, 2015, in particular a significant reduction in emissions from Miami Fort. Miami Fort Unit 6 (Ohio EPA unit ID B007), an uncontrolled unit, was shutdown as of June 1, 2016 to comply with the Mercury and Air Toxics Standards (Appendix H). This has resulted in a further 18,796 ton reduction from 2014 levels. Thus, derivation of a background from the study period analyzed by Ohio EPA likely overestimates the true SO₂ background concentration for the source area.

Ohio EPA compiled the first through 30th highest hourly monitored SO₂ concentrations for all hours during the 2012-February 28, 2015 period for which SO₂ emissions from the Walter C. Beckjord facility were zero. These data are presented in Table 1, below.

Monitor 21-037-3002		
Date	Hour	Monitor Value (ppb)
January 14, 2015	10	34
September 2, 2013	7	29
January 14, 2015	9	26
January 6, 2015	19	24
September 4, 2013	17	20
January 14, 2015	11	20
May 17, 2013	12	19
August 22, 2014	11	19
January 8, 2015	1	19
September 22, 2012	9	18
September 2, 2014	17	18
January 5, 2015	9	18
January 6, 2015	21	18
September 2, 2013	6	17
January 6, 2015	18	17
August 27, 2014	15	15
January 9, 2015	22	15
January 6, 2015	17	14
January 6, 2015	20	14
January 9, 2015	21	14
September 30, 2012	10	13
May 17, 2013	11	13
November 12, 2014	16	13
January 5, 2015	13	13
January 22, 2015	16	13
September 14, 2012	11	12
October 9, 2013	10	12
October 28, 2014	15	12
September 30, 2012	11	11
May 25, 2013	11	11

Table 1: Highest hourly monitored SO₂ concentrations, 2012-February 28, 2015, monitor 21-037-3002, Walter C. Beckjord impacts removed.

To maintain conservatism, Ohio EPA eliminated monitor values of zero from the percentile calculation, giving a total of 2,939 non-zero monitor values for which SO₂ emissions from the Walter C. Beckjord facility were zero. Thus, the 99th percentile value

of these data is the 29th highest hourly value. This value, 11 ppb, was recorded on September 30, 2012 and is highlighted in Table 1, above.

Ohio EPA has demonstrated that a significant shift in wind directions which impact monitor 21-037-3002 are observed when emissions from the Walter C. Beckjord facility are eliminated from hourly wind and monitor data. From amongst this dataset, the highest monitor value recorded was 34 ppb, and the 99th percentile of the non-zero values is 11 ppb. Those sources impacting the monitor and source area in the absence of emissions from the Walter C. Beckjord facility are located 30 to 35 km and are therefore unlikely to cause a significant concentration gradient. Thus, monitor values are considered representative of ambient SO₂ concentrations across the source area. Additionally, a significant reduction in SO₂ emissions has been observed for those sources around the source area. Ohio EPA contends that the monitor is representative of the impacts of sources surrounding the William H. Zimmer source area, and that a background value of 11 ppb is a conservative estimate of the future SO₂ background in this area.