Appendix F
Background Concentration Determination for Non-Attainment Area
January 23, 2015

U.S.EPA issued the "Guidance for 1-Hour SO_2 Nonattainment Area SIP Submissions" on April 23, 2014. In Appendix A of the guidance, several approaches for determining the SO_2 background concentrations are suggested. In this appendix, Ohio EPA, working with the Kentucky DAQ, has applied the methods suggested in U.S. EPA's guidance to identify the potential SO_2 background concentration in the Campbell County KY-OH, nonattainment area for the 1-hour SO_2 National Ambient Air Quality Standard (NAAQS).

According to the guidance, a "first tier" approach uses a uniform monitored background contribution based on the overall highest hourly background SO_2 concentration from a representative monitor. However, this approach is identified as "… conservative in many cases and may also be prone to reflecting source-oriented impacts, increasing the potential for double-counting of monitored contribution." Therefore, U.S.EPA recommends a less conservation "first tier" method based on the monitored design values for the latest 3-year period. From the design value report (See Appendix A-2 of the Redesignation Request and Maintenance Plan) at Monitor 21-037-3002 for 2012-2014, the 3-year design value is 72 ppb, which is slightly less than the 2010 1-hour SO_2 NAAQS. Thus, both of the "first tier" methods are overly conservative and are not appropriate for determining the background concentration of this area.

As discussed in U.S. EPA's guidance, Section 8.2.2.b of Appendix W provides another option:

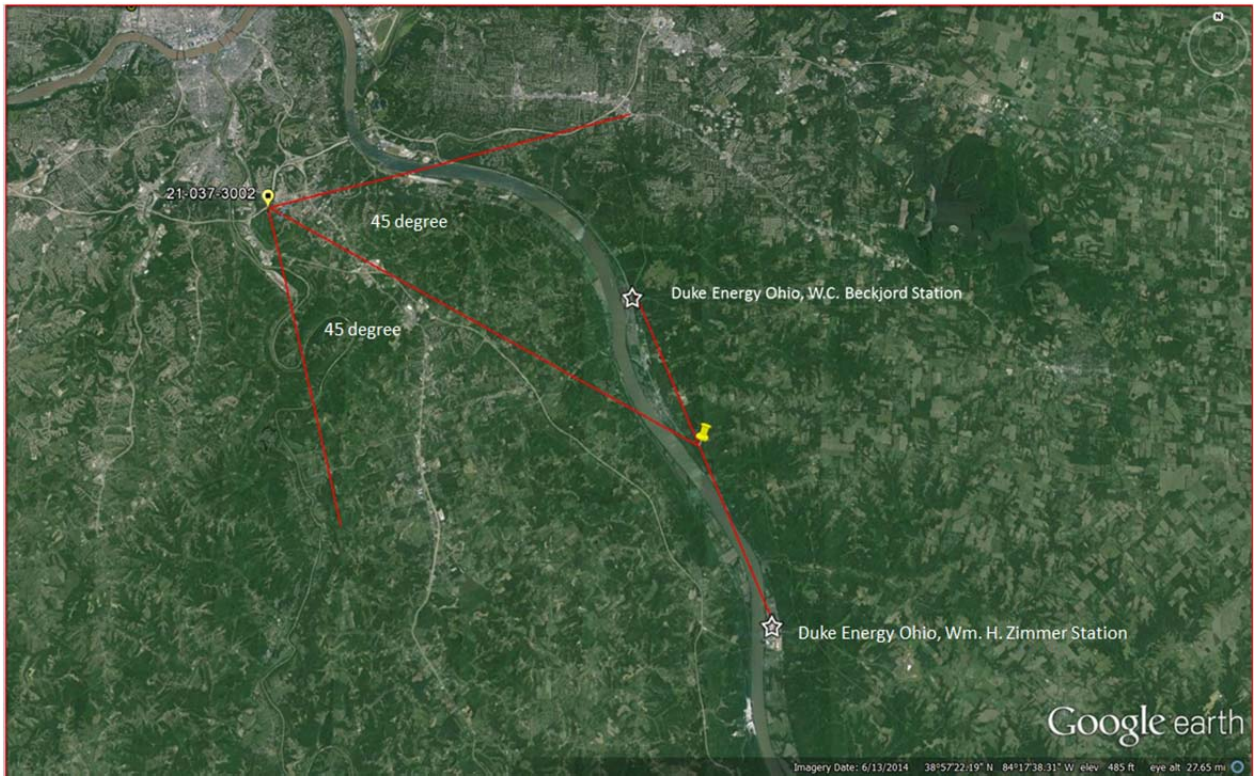
> "Use air quality data in the vicinity of the source to determine the background concentration for the averaging times of concern. Determine the mean background concentration at each monitor by excluding concentrations when the source in question is impacting the monitor…For shorter time periods, the meteorological conditions accompanying concentrations for concern should be identified. Concentrations for meteorological conditions of concern, at monitors, not impacted by the source in question, should be averaged for separate averaging time to determine the average background value. Monitoring sites inside a 90 degree sector downwind of the source may be used to determine the area of impact."

The Kentucky monitor 21-037-3002 is the only monitor located in the vicinity of our study area suitable for this analysis. Two major SO_2 emission sources, Duke Energy's W.C. Beckjord (Beckjord) and W. H. Zimmer (Zimmer) facilities were considered as a part of this analysis and concentrations were excluded when these sources in question were impacting the monitor.

Google Earth tools were used to determine an arc of 90 degrees when these two sources in question are impacting the monitor, and the hourly meteorological data (WBAN: 93814) was downloaded via ftp://ftp.ncdc.noaa.gov/pub/data/noaa/isd-lite. As can be seen in the Figure 1 below, these two sources would impact the monitor when

the wind blows from 74.81° to 164.81°. Therefore, the hourly monitoring data with the recorded wind directions within the range were eliminated.

Figure 1



The average SO_2 concentration was then calculated for each year in the 2010-2014 dataset which was retrieved from U.S. EPA's Air Quality System (AQS). Data for 2014 was only available through August 31, 2014 at the time of this analysis. In addition, to be more conservative, the annual average SO2 concentrations for non-zero values were calculated. The results show the highest value, 4.40 ppb, is the background concentration for this area using this approach (see Table 1).

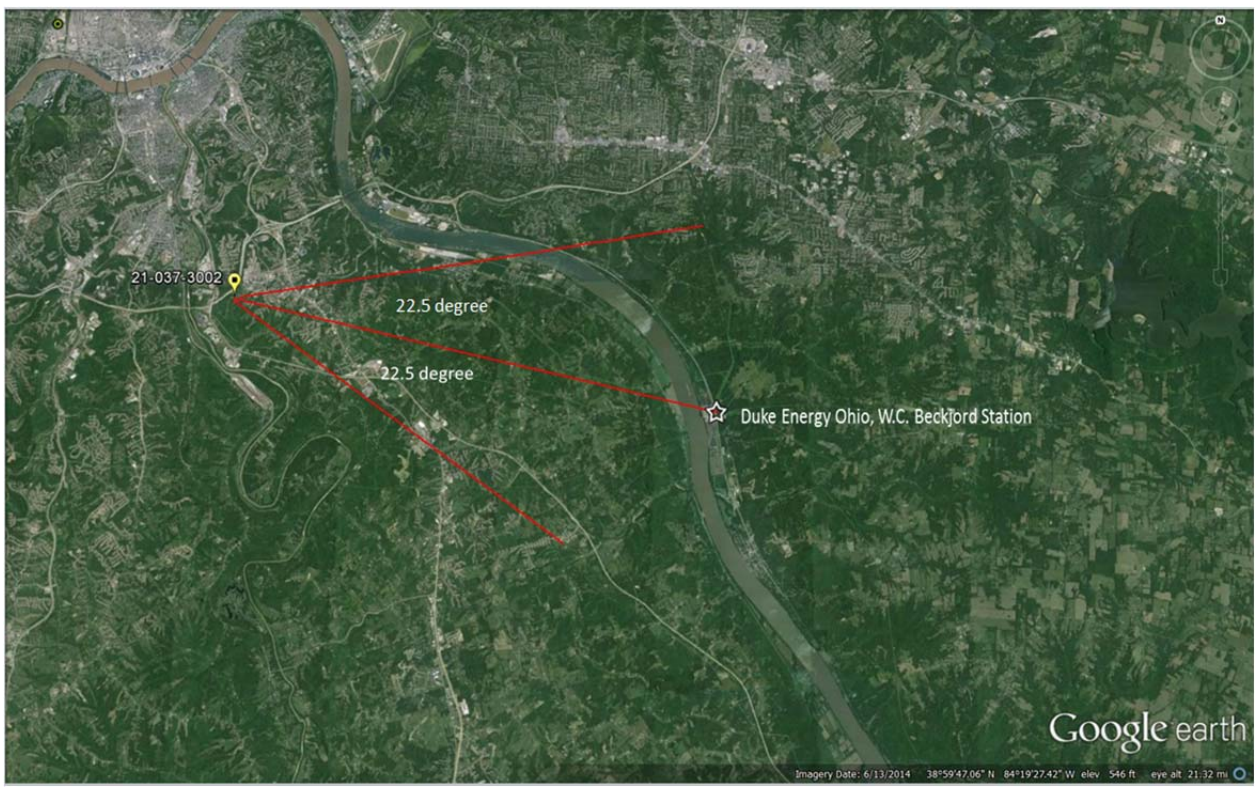
Table 1

Year	Background Concentration (all data) (unit: ppb)	Background Concentration (non-zero) (unit: ppb)
2010	3.82	4.36
2011	2.12	4.10
2012	1.16	3.91
2013	1.01	4.40
2014[1]	1.86	2.89

[1] Through August 31, 2014

Because it has been determined that Beckjord is the only source impacting this monitor, and given their proximity to the monitor and the predominant wind directions potentially impacting the monitor, the same analysis was also conducted and concentrations were excluded only when Beckjord was impacting the monitor. Again, Google Earth tools were used to determine an arc of wind directions to exclude from the background determination. In this instance, a reduced arc of 45 degrees was used instead of 90 degrees. It was determined that an exclusion arc of 90 degrees relative to the monitor would potentially eliminate any potential contributions of Zimmer emissions to monitor values. The reduced arc allows for the exclusion of Beckjord emission impacts, the inclusion of Zimmer impacts, and provides an additional measure of conservatism to the background determination. The hourly meteorological data (WBAN: 93814) was downloaded via ftp://ftp.ncdc.noaa.gov/pub/data/noaa/isd-lite. As can be seen in the Figure 2 below, Beckjord would impact the monitor when the wind blows from 81° to 126°. Therefore, the hourly monitoring data with the recorded wind directions within the range were eliminated.

Figure 2



The average SO_2 concentration was then calculated for each year in the 2010-2014 dataset. Again, to be more conservative, the annual average SO_2 concentrations for non-zero values were calculated. The results show the highest value, 4.76 ppb, is the background concentration for this area using this approach (see Table 2).

Table 2

Year	Background Concentration (all data) (unit: ppb)	Background Concentration (non-zero) (unit: ppb)
2010	3.82	4.49
2011	1.94	4.28
2012	1.03	4.29
2013	0.8	4.76
2014[2]	1.66	2.91

In summary, the background concentration for this area can be conservatively estimated at 4.76 ppb without double-counting emissions from Beckjord based on the above analysis.

[2] Through August 31, 2014