

Appendix O:

Background Determinations for Refined Dispersion Modeling Analyses

In order to perform designations modeling for those sources meeting the modeling criteria of the Data Requirements Rule (DRR), Ohio EPA conducted multiple analyses to determine representative and conservative background concentrations for each source area. Ohio EPA established, with a single exception, background concentrations for the 2012 to 2014 period, which are representative of those sources thought to contribute to current and historical monitored concentrations, but are not explicitly modeled. Because of the highly varied terrain, land use, meteorological conditions, and the number of sources included in the separate modeling analyses, Ohio EPA determined background for each source area on a case-by-case basis rather than following a single prescribed methodology for each background.

Background Determination: W. H. Sammis Source Area

Data Description:

Background for the modeling analysis of the W.H. Sammis source area was determined using data collected at ambient air quality monitor 54-029-0005, located in Hancock County, West Virginia approximately 4.7 kilometers to the East of the W.H. Sammis facility. A seasonal and hourly varying background was determined from this monitor by excluding data from the monitor during times when the wind was coming from the direction of the W.H. Sammis facility.

Hourly ambient SO₂ concentrations recorded at monitor 54-029-0005, years 2012 to 2014, were compiled from U.S. EPA's Technology Transfer Network, Air Quality System (AQS). Likewise, hourly climate data for the same time period was acquired from the National Climatic Data Center (<http://www.ncdc.noaa.gov/>) for meteorological station #94823, located at the Greater Pittsburgh International Airport.

Methodology:

The hourly monitored SO₂ concentrations and wind direction data for the three-year period were aligned temporally. A narrow 45° sector of wind directions (251° - 296°) was identified by finding the centerline heading between the monitor and the W.H. Sammis facility (273.5°). U.S. EPA's February 2016 Modeling Technical Assistance Document suggests using a wind sector up to 90° for eliminating the impacts associated with nearby sources, and as such, Ohio EPA understands that the use of a narrower wind sector provides for a more conservative background. Winds from these directions were assumed to bring emissions from the W.H. Sammis facility to the monitoring location. Therefore, to eliminate double counting when included in the modeling analysis for this source area, all hourly monitored concentrations recorded during hours when winds originated from the wind sector described above were eliminated from the

dataset. Figure 1 shows the spatial relationship between the W.H. Sammis facility, monitor 54-029-0005, and the 45° wind sector used to filter the monitoring data.



Figure 1: Monitor and source locations with 251° - 296° wind sector.

A three-year average of each hour was then calculated from the annual databases, filtered by wind direction, as described above. To maintain conservatism in the background values, only non-zero hours were included in the averaging, and all averages were rounded up to the nearest tenth of part per billion. The three-year average dataset was then subdivided in to season and hourly datasets. For each hour of each season, the 99th percentile value was taken as the background value for that hour. Ohio EPA contends that the use of only non-zero hours in the averaging methodology, rounding of all averages upwards, a narrower wind sector than that suggested by U.S. EPA guidance, and the use of the 99th percentile concentration for each hour provides for a highly conservative set of background values for inclusion in the modeling analysis.

Results:

The season and hourly variable background for the W.H. Sammis source area is shown in Figure 2, below.

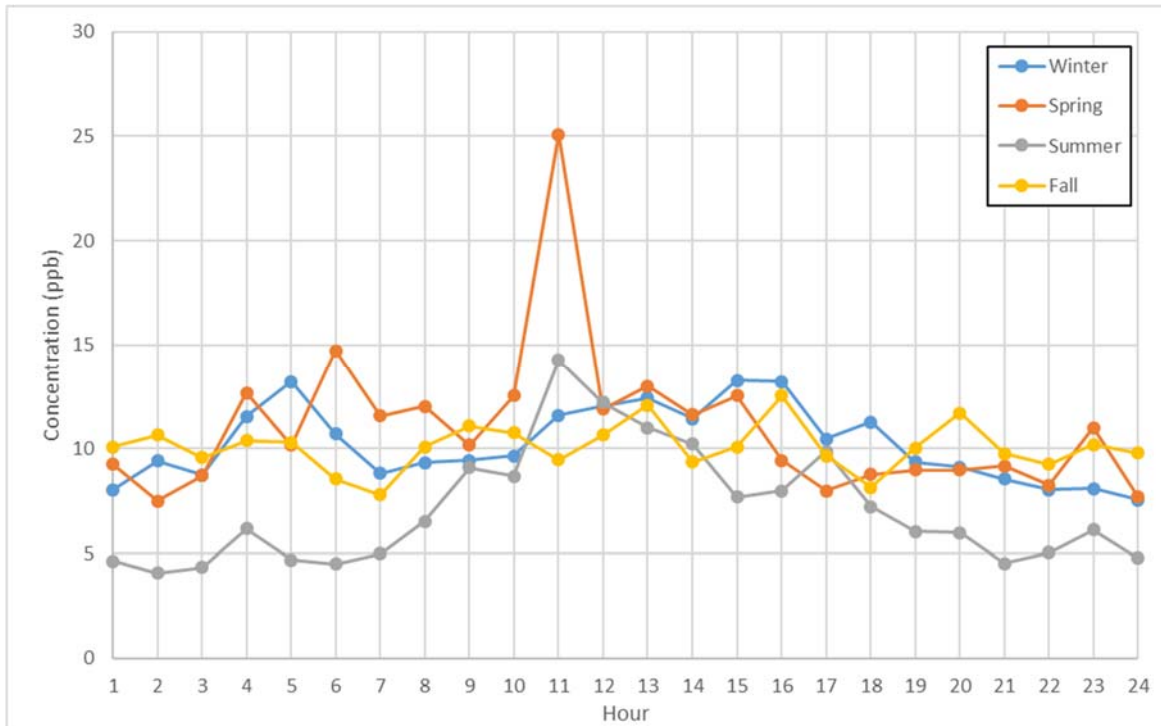


Figure 2: Hourly and seasonally variable SO₂ background, derived from air quality monitor 54-029-0005 for the W.H. Sammis source area.

The hourly background values for each season shown in Figure 2 above are consistently above the seasonal averages from the un-filtered monitoring data (all valid monitor hours) from this monitor which are:

- Winter: 5.1 ppb
- Spring: 4.3 ppb
- Summer: 3.8 ppb
- Fall: 4.5 ppb

Considering the conservative approach to filtering the original dataset with a narrow 45° wind sector and the averaging of only non-zero monitor values, Ohio EPA contends that the seasonal and hourly variable background applied in the W.H. Sammis source area modeling is conservative and representative of those sources not explicitly included in the modeling domain.

Background Determination: Carmeuse Lime Maple Grove Operations

Data Description:

For the modeling analysis performed for the Carmeuse Lime Maple Grove facility, Ohio EPA utilized a fixed background concentration, informed by screen-level modeling. Background was determined in this manner as there are no ambient air quality monitors

located sufficiently close to the source area to allow a representative background to be determined from monitored data.

Methodology and Results:

The largest source up-wind of the Carmeuse Lime Maple Grove facility is the Sunny Farms Landfill, located 22 kilometers to the southwest of the Carmeuse Lime Maple Grove facility. Sunny Farms Landfill operates a single flare, with SO₂ emissions of approximately 300 tons per year. This flare was modeled using both SCREEN3 and AERSCREEN. The least conservative of these results, taken as the highest 1-hour concentration at a distance of 22 kilometers, was utilized as the background concentration. In this instance, the least conservative value was obtained from the SCREEN3 model, which yielded the maximum 1-hour concentration of 31.392 µg/m³, or 12 ppb. Given the rural nature of the source area, lack of significant sources, and approximately 80% agricultural land use in Seneca and surrounding counties, Ohio EPA contends that this background is extremely conservative for this source area.

Background Determination: Conesville Power Plant

Data Description:

For the modeling analysis performed for the Conesville Power Plant source area, Ohio EPA utilized a fixed background concentration of 8 ppb. This was done as there are no ambient air quality monitors located sufficiently close to the source area to allow a representative background to be determined from monitored data.

Methodology and Results:

The U.S. EPA Region 5 States and the Lake Michigan Air Directors Consortium (LADCO) drafted in 2011 a modeling protocol for the 1-hour SO₂ standard. A portion of this document presented a study of the two state-operated rural SO₂ monitors in the region: one in northern Wisconsin (Forest County, 55-041-0007) and one in southeastern Iowa (Lake Seguma). The 2007-2009 1-hour design values at these sites were 8 and 5 ppb, respectively. A more recent 2012-2014 design value of 7 ppb was recorded at the Wisconsin monitoring location. As the Conesville Power plant represents 99.5% of the total 2014 SO₂ emissions within 25 kilometers, it is highly unlikely that a background beyond 8 ppb, representative of a rural location, would be necessary or representative of this area.

Background Determination: Miami Fort Station Source Area

Data Description:

Background for the modeling analysis performed for the Miami Fort source area was determined using data collected at ambient air quality monitor 39-061-0010, located in Hamilton County, Ohio approximately 15 kilometers to the Northeast of the Miami Fort facility. Hourly ambient SO₂ concentrations recorded at monitor 39-061-0010, years

2012 to 2014, were compiled from U.S. EPA's Technology Transfer Network, Air Quality System (AQS).

Methodology:

Because of the number of sources located in the source area, the filtering of the hourly monitor data using wind directions to eliminate the impact of the Miami Fort Station was determined not to be possible. As such, there is likely a high degree of double counting of the impact of Miami Fort emissions via the use of the background derived here in the modeling analysis. As such, this background is considered highly conservative by Ohio EPA. The seasonal and hourly varying background was derived using the following methodology.

Firstly, a three-year average of each hour was calculated from the annual database of hourly concentrations. Due to the high degree of double counting that is likely to be introduced to the modeling results via inclusion of this background, both zero and non-zero values were included in the averaging. The three-year average dataset was then subdivided into season and hourly datasets. For each hour of each season, the 99th percentile value was taken as the background value for that hour of each season.

Results:

The season and hourly variable background for the Miami Fort source area is shown in Figure 3, below.

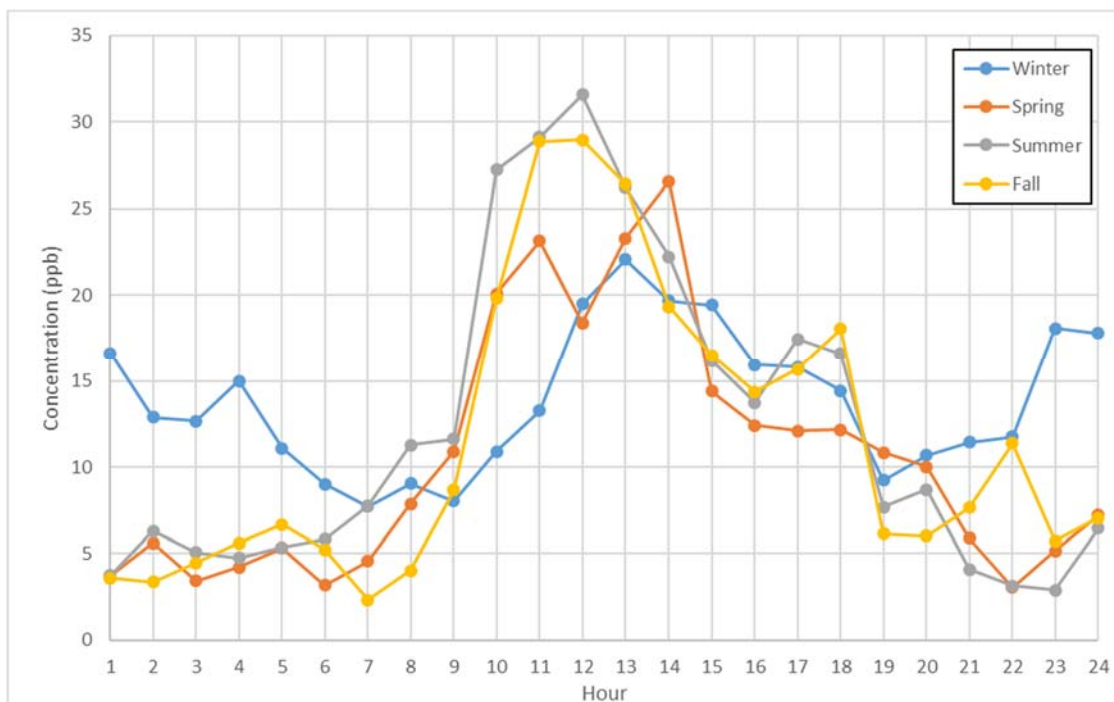


Figure 3: Hourly and seasonally variable SO₂ background, derived from air quality monitor 39-061-0010 for the Miami Fort Station source area.

The hourly background values for each season shown in Figure 3 above are consistently above the seasonal averages from the same monitor which are:

- Winter: 2.3 ppb
- Spring: 1.6 ppb
- Summer: 2.0 ppb
- Fall: 2.4 ppb

Considering the conservative approach of not attempting to remove any impacts of emissions from Miami Fort Station in the monitor data via wind direction information or other methods, Ohio EPA contends that the seasonal and hourly variable background applied in the Miami Fort Station source area modeling is conservative, and likely over-representative of those sources not explicitly included in the modeling domain, many of which have or are scheduled to shutdown.

Background Determination: Bay Shore and BP Husky Source Area:

Data Description:

Background for the modeling analysis of the Bay Shore source area was determined from data collected at ambient air quality monitor 39-095-0008, located in Lucas County, Ohio approximately 4.5 kilometers to the Southwest of the Bay Shore facility. Background was determined from this monitor by excluding concentration data from the monitor during times when the wind was coming from the direction of the Bay Shore facility.

Hourly ambient SO₂ concentrations recorded at monitor 39-095-0008, years 2013 to 2015, were compiled from U.S. EPA's Technology Transfer Network, Air Quality System (AQS). It should be noted that monitor 39-095-0008 did not begin operation until January 1, 2013, and experienced several outages during the 2013 to 2015 period. All valid data periods, years 2013 to 2015, were considered for this analysis, and this period of record is henceforth referred to as the study period. Likewise, hourly climate data for the same time period was acquired from the National Climatic Data Center (<http://www.ncdc.noaa.gov/>) for meteorological station #4848, located at the Toledo Executive Airport, KTDX, formerly known as Metcalf Field.

Methodology:

The available hourly monitored SO₂ concentrations and wind direction data for the three-year period were aligned temporally. A narrow 45° sector of wind directions (22° - 67°) was identified by finding the centerline heading between the monitor and the Bay Shore facility (44.5°). U.S. EPA's February 2016 Modeling Technical Assistance Document suggests a wind sector up to 90° for eliminating the impacts associated with nearby sources, and as such, Ohio EPA understands that the use of a narrower wind sector provides for a more conservative background. Winds from these directions were assumed to bring emissions from the Bay Shore and BP Husky facilities to the

monitoring location. Therefore, to eliminate double counting when the background is included in the modeling analysis, all hourly monitored concentrations recorded during a times when winds originated from the narrow wind sector were eliminated from the dataset. Figure 4 shows the spatial relationship between the Bay Shore facility, monitor 39-095-0008, and the 45° wind sector described above.



Figure 4: Monitor and source locations for the Bay Shore and BP Husky source area, with 22° - 67° wind sector.

A three-year average of each hour was then calculated (where possible) from the annual databases filtered by wind direction as described above. To maintain conservatism in the background, only non-zero hours were included in the averaging, and all averages were rounded up to the nearest tenth of a part per billion. The three-year average dataset was then subdivided into season and hourly datasets. For each hour, the 99th percentile value was taken as the background value for that hour of each season. Ohio EPA contends that the use of only non-zero hours in the averaging methodology, rounding of all averages upwards, and the use of the 99th percentile concentration for each hour provides a highly conservative set of background values for inclusion in the modeling analysis.

Results:

The season and hourly variable background for the Bay Shore source area is shown in Figure 5, below.

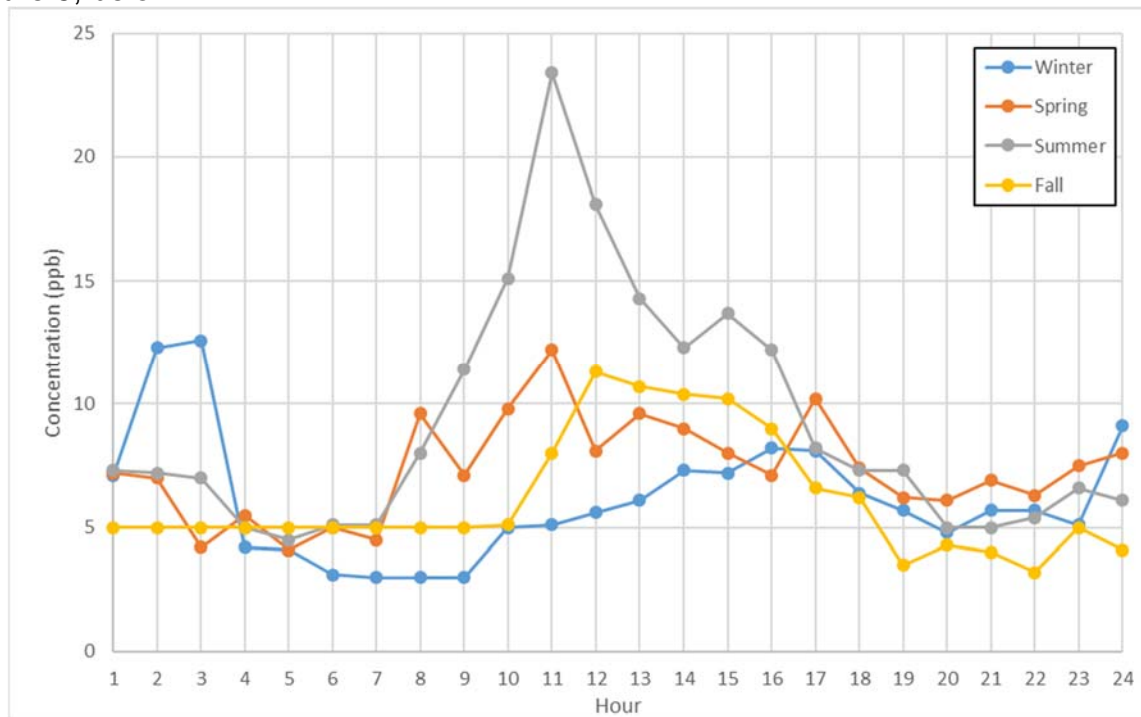


Figure 5: Hourly and seasonally variable SO₂ background, derived from air quality monitor 39-095-0008 for the Bay Shore and BP Husky source area.

The hourly background values for each season shown in Figure 5 above are consistently above the seasonal averages from the un-filtered dataset from this monitor which are as follows:

- Winter: 1.2 ppb
- Spring: 1.5 ppb
- Summer: 1.5 ppb
- Fall: 1.0 ppb

Considering the conservative approach to filtering the original dataset with a narrow 45° wind sector and averaging of only non-zero monitor values, Ohio EPA contends that the seasonal and hourly variable background applied in the Bay Shore and BP Husky source area is conservative and representative of those sources not explicitly included in the modeling domain.

Background Determination: DP&L Stuart and Killen Stations:

Data Description:

Background for the modeling analysis of the Stuart and Killen source area was determined from data collected at ambient air quality monitor 39-001-0001, located in Adams County, Ohio. This monitor is located 12.5 kilometers to the Northwest of Killen Station and 23 kilometers to the Northeast of Stuart Station. Hourly ambient SO₂ concentrations recorded at monitor 39-001-0001, years 2012 to 2014, were compiled from U.S. EPA's Technology Transfer Network, Air Quality System (AQS).

Methodology:

Because of the number of sources located in the source area, the filtering of the hourly monitor data using wind directions to eliminate impacts of the Stuart and Killen power plants was determined not to be possible. As such, there is likely a high degree of double counting of the impact of emissions from both facilities via the use of the background derived here in the modeling analysis. As such, this background is considered highly conservative by Ohio EPA. The seasonal and hourly varying background was derived using the following methodology.

Firstly, a three-year average of each hour was calculated from the annual database of hourly concentrations. To maintain conservatism, only non-zero values were included in the calculation of averages. All averages were rounded up to the nearest tenth of a part per billion. Then, the three-year average dataset was then subdivided into season and hourly datasets. For each hour, the 99th percentile value was taken as the background value for that hour of each season.

Results:

The season and hourly variable background for the Stuart and Killen Station source area is shown in Figure 6, below.

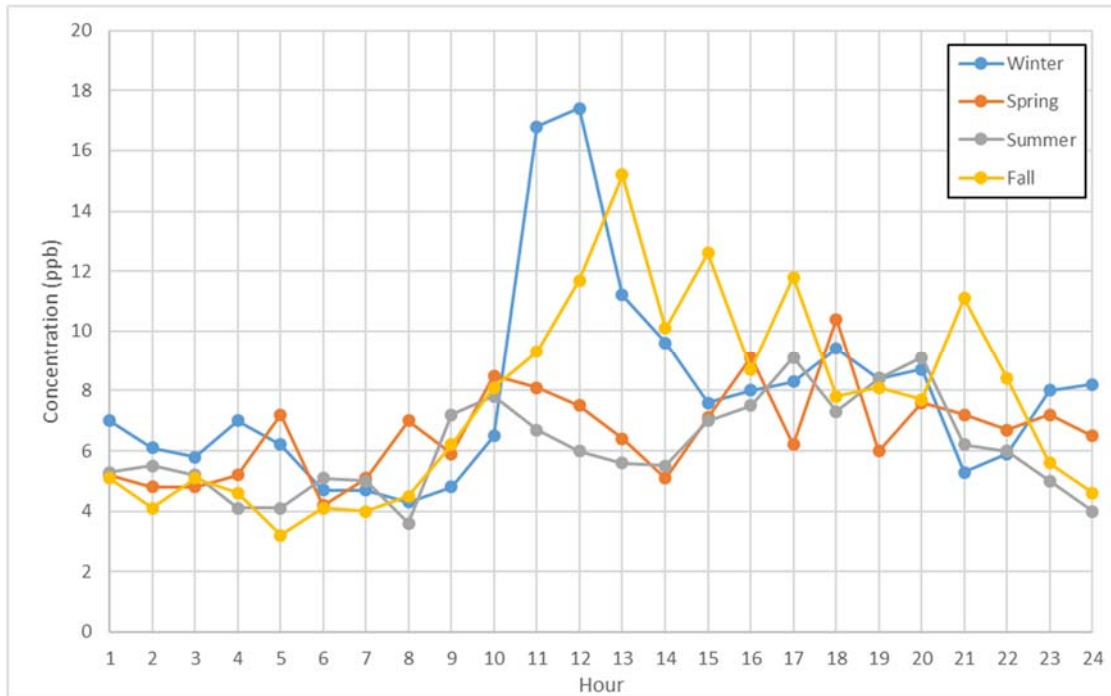


Figure 6: Hourly and seasonally variable SO₂ background, derived from air quality monitor 39-001-0001 for the Stuart and Killen Station source area.

The hourly background values for each season shown in Figure 6 above are consistently above the seasonal averages from the same monitor which are:

- Winter: 2.0 ppb
- Spring: 1.2 ppb
- Summer: 1.1 ppb
- Fall: 1.5 ppb

Considering the conservative approach of not attempting to remove any impacts of emissions from explicitly modeled sources in the monitor data via wind direction information or other methods, Ohio EPA contends that the seasonal and hourly variable background applied in the modeling analysis of the Stuart and Killen Station source area is conservative, and likely over-representative of those sources not explicitly included in the modeling domain.