UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
FOUR PENN CENTER – 1600 JOHN F. KENNEDY BLVD.
PHILADELPHIA, PENNSYLVANIA 19103

MEMORANDUM

SUBJECT: Model Clearinghouse Concurrence Request For A Case-Specific Alternative Model for Characterizing 1-hour SO_2 In Complex Terrain Along The Laurel Ridge in Westmoreland and Cambria Counties, Pennsylvania

FROM: Timothy A. Leon Guerrero, Meteorologist
Air Analysis Branch, Air & Radiation Division
EPA Region 3, Philadelphia, Pennsylvania

TIMOTHY LEON-GUERRERO
Digitally signed by TIMOTHY LEON-GUERRERO
Date: 2026.02.02 08:58:48 -05'00'

THROUGH: Alice Chow, Branch Chief
Air Analysis Branch, Air & Radiation Division
EPA Region 3, Philadelphia, Pennsylvania

ALICE CHOW
Digitally signed by ALICE CHOW
Date: 2026.02.02 09:10:02 -05'00'

TO: George Bridgers, Director of Model Clearinghouse
Air Quality Modeling Branch, Air Quality Assessment Division
Office of State Air Partnerships

(via email at bridgers.george@epa.gov)

The U.S. Environmental Protection Agency (EPA) Region 3 office seeks a concurrence from the Model Clearinghouse regarding its approval of a request for the use of an alternative model for the Cambria-Westmoreland, PA 1-hour sulfur dioxide (SO_2) nonattainment area, which covers portions of Cambria and Westmoreland counties in western Pennsylvania (see 89 FR 101910 for additional information on nonattainment area designation). This alternative model request, which Region 3 is approving, is for the use of a non-regulatory option in the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD); specifically, we are seeking concurrence to utilize a minimum sigma-v value setting of 0.5 m/s via the model's LOW_WIND option.

A formal request to use this alternative model was submitted by AECOM on January 21, 2026. AECOM prepared this request on behalf of the Conemaugh Generating Station and the Seward Generating Station (collectively referred to as the Stations). This alternative model request was prepared to comply with section 3.2.2 (b) of 40 CFR Part 51 Appendix W to Part 51, Guideline on Air Quality Models (82 FR 5182) or Appendix W. Section 3.2.1(b) of Appendix W outlines the general process of how alternative models are approved. In accordance with this section, Regional Administrators have delegated authority to issue such approvals under section 3.2 of Appendix W. Such approvals are issued after consultation with the EPA's Model Clearinghouse and formally documented in a concurrence memorandum from the EPA's Model Clearinghouse, which demonstrates that the requirements within section 3.2 for use of an alternative model have been met.

The EPA Region 3 Regional Administrator based her approval of the Stations' request to adjust AERMOD's sigma-v value to 0.5 m/s through the model's LOW_WIND option in accordance with 40 CFR Part 51, Appendix W §3.2.2(b)(3). Under 3.2.2(b)(3), an alternative model may be used if the

Regional Office finds the conditions specified in Appendix W §3.2.2(e) are satisfied. AECOM's alternative model request memo presents specific responses to the 5 points (*i*-*v*) outlined in section 3.2.2(e).

The EPA Region 3 office worked with AECOM, the Stations and representatives from the Pennsylvania Department of Environmental Protection (PA DEP) to thoroughly review and document this submittal and agrees that an alternative model (with LOW_WIND option with minimum sigma-v setting of 0.5 m/s) is justified for this case-specific application. A summary of these points will be presented in the following sections of this memo. AECOM and the Stations' alternative model request submittal is also included as an enclosure. Again, we seek the Model Clearinghouse's concurrence for this case-specific application of AERMOD's LOW_Wind option, which will ultimately be utilized in a Clean Data Determination (CDD) for the Cambria-Westmoreland, PA 1-hour SO_2 nonattainment area.

Background and Project Overview

The EPA finalized redesignating portions of Cambria and Westmoreland counties in Pennsylvania, to ''nonattainment'' for the 2010 1-hour primary SO_2 National Ambient Air Quality Standard (NAAQS) in December of 2024 (89 FR 101910) with an effective date of January 16, 2025. This redesignation was based on modeled violations of the health-based 1-hour SO_2 NAAQS confined to the higher elevations of the nearby Laurel Ridge just east of the Stations. The EPA used the regulatory version of AERMOD with actual emissions over a three-year period from July 1, 2017, through June 30, 2019, one year of AERMET processed site-specific meteorological data collected at the Ash #1 site and an appropriate background concentration for the basis of its nonattainment redesignation.

On April 8, 2025, at the request of the EPA, PA DEP convened a meeting with EPA Region 3, the Stations and their consultant. The EPA Region 3 office informed the Stations that a CDD based on air quality dispersion modeling demonstrating attainment of the 1-hour SO_2 NAAQS on and in the vicinity of Laurel Ridge was an available option. Similar CDD actions were recently completed for Anne Arundel-Baltimore, MD (89 FR 72770) and Piti-Cabras, Guam (90, FR 26235). Following the enactment of the Clean Air Act (CAA) Amendments of 1990, the EPA established the "Clean Data Policy" for the 1-hour ozone NAAQS (57 FR 13498). The Clean Data Policy states that for a nonattainment area that can demonstrate attainment of the standard prior to the implementation of CAA nonattainment measures, no additional control measures would be required so long as air quality continues to meet the standard. In an April 23, 2014, memorandum entitled "Guidance for 1-hour SO_2 Nonattainment Area SIP Submissions" (US EPA, 2014), the EPA provided guidance and a rationale for the application of the Clean Data Policy to the 2010 1-hour primary SO_2 NAAQS. The Stations elected to proceed with this CDD approach using updated (more recent) emissions data from the sources impacting the Laurel Ridge along with an appropriate background concentration.

The topographic setting along with the orientation of the complex terrain relative to nearby SO_2 emission sources (primarily the nearby Stations) introduces unique challenges to dispersion modeling along portions of the Laurel Ridge. These include potential wind direction shear with elevation and other physical processes that act to expand horizontal spreading of emission plumes when they are forced to "wrap around" a complex terrain feature such as the nearby Laurel Ridge. Under these circumstances, the current model formulation of AERMOD, in its regulatory form, may not account for these impacts and may produce overly high model concentrations along portions of the Laurel Ridge covered by the EPA's redesignated Cambria-Westmoreland, PA nonattainment area.

To test the validity of these possible AERMOD deficiencies, AECOM and the Stations have suggested using an earlier field study to support an alternative formulation of AERMOD. In the early 1990s, a field study was conducted by the TRC Companies (TRC) to determine suitable modeling approaches, especially in elevated terrain, for several coal-fired electric generating stations located in Indiana and Armstrong counties in western Pennsylvania. This study was funded by Penelec, the former owner and operator of four nearby power plants, including earlier operating versions of the current Stations. Ten (10) ambient air SO_2 monitors were deployed across the Conemaugh Valley, with several of the monitors located on Laurel Ridge within the Cambria-Westmoreland, PA nonattainment area. This study also included deployment and operations of two (2) tall meteorological towers. At the time this study was conducted, the 1-hour SO_2 NAAQS had not yet been established; the standard was promulgated in 2010 (75 FR 35520). The original study was focused on the prior 3-hour and 24-hour SO_2 NAAQS. Hourly averaged emissions data, monitoring data and meteorological data, however, were collected ensuring the ability to conduct 1-hour averaged modeling from this study.

The Stations have proposed using this study data set to examine if modifying the minimum sigma-v value through AERMOD's LOW_WIND option from the regulatory default value of 0.2 m/s to 0.5 m/s would produce better model performance: model concentrations closer to actual monitor values. If the model performance is improved utilizing this option and formally approved as an alternative model following section 3.2.2 (b) of Appendix W, then it would be applied for the Stations' CDD modeling analysis.

The following sections of this Alternative Modeling request memo will outline the technical basis of this request, the modeling approach used in this analysis, a review of the alternative modeling analysis including an overview of the regulatory requirements, modeling analysis and a summary of model performance statistics. We expect this summary will provide justification for the EPA Region 3 office's alternative model approval under the appropriate statutes and allow a concurrence conclusion from the Model Clearinghouse.

Evaluation of Approach Under Appendix W Section 3.2.2(e)

Justification for modifying the minimum sigma-v value is discussed in more detail below for each of the 5 elements in Appendix W section 3.2.2(e). The EPA Region 3 has reviewed the Stations' final report (Exhibit B) considering these 5 elements and determined that the alternative model request is supported for each element.

(i) The model or technique has received a scientific peer review

The Sources have presented a number of peer reviewed studies regarding low-wind condition impacts on atmospheric dispersion. The EPA has recognized many of these impacts and provided options within its primary near-field dispersion model, AERMOD, based on some of these principles.

The EPA's AERMOD formulation document (US EPA, 2024a) and user's guide (US EPA, 2024b) provide ways to investigate possible improvements to AERMOD performance through the primary keyword LOW_WIND within the model's input file. The EPA has identified two areas of model improvements to address these low wind issues:

1. Plume meander: adjustments to the treatment of plume meander within AERMOD and the modifications to the meander components, and

2. Meteorology and turbulence: adjustments to the minimum turbulence values, specifically the minimum sigma-v value and the sigma-w value, which are components of the turbulence, as well as the minimum wind speed, which is closely tied to the minimum turbulence values.

The second point is the primary focus of the Stations' alternative model request. The LOW_WIND technique, specifically where the minimum sigma-v is increased, has been evaluated using AERMOD in complex terrain in peer-reviewed journal articles (Hanna 1983, 1990) and satisfies this particular element of Appendix W section 3.2.2(e).

(ii) The model or technique can be demonstrated to be applicable to the problem on a theoretical basis

The Stations note that the close proximity of their stacks to the Laurel Ridge presents dispersion modeling challenges for this site-specific area. This includes potential impacts from low wind conditions and vertical shear, terrain induced eddies, and flow perpendicular to significant terrain features. Both of these impacts are possible and could contribute to overly high predicted AERMOD concentrations on the higher elevations of the Laurel Ridge.

A parameter that is used in the computation of the horizontal plume spreading in AERMOD (which accounts for meandering in low wind conditions) is the standard deviation of the crosswind component, sigma-v. This variable can be parameterized as being proportional to the friction velocity, u* (Smedman, 1988; Mahrt, 1998). These investigators found that there was a minimum, non-zero value of sigma-v that can be attributed to wind meandering over the course of a given hour. Hanna (1983) found that the hourly-averaged sigma-v has a non-zero minimum value of about 0.5 m/s as the wind speed approaches zero. Chowdhury et al. (2016) noted, based upon research conducted by Hanna (1983) that a minimum sigma-v of 0.5 m/s is justified.

The EPA believes the Stations have adequately demonstrated that a change of the minimum sigma-v is justified in this situation and an appropriate value (0.5 m/s) has been selected and therefore satisfies this element of Appendix W.

(iii) The databases which are necessary to perform the analysis are available and adequate

The Stations identified a suitable field study to determine whether the proposed usage of AERMOD's LOW_WIND option would provide a statistically significant improvement in model performance along the Laurel Ridge. Penelec, the former owner of 4 coal-fired power plants in Armstong and Indiana counties, supported a field study conducted by the TRC in the early 1990s. This study consisted of hourly emissions data from large coal-fired boilers operating at the Conemaugh Generating Station, Home City Generating Station, Keystone Generating Station and Seward Generating Station, hourly monitoring data from ten (10) SO_2 monitors placed along the Chestnut and Laurel ridges and hourly wind, temperature and turbulence measurements collected at 2 tall meteorological tower sites. Originally, the field study was designed to compare model performance for the four coal-fired sources regarding impacts on the 3-hour and 24-hour SO_2 NAAQS; the 1-hour SO_2 NAAQS was not enacted until 2010. Nevertheless, this study could be used to perform an analysis of the impacts of using AERMOD's LOW_WIND option as proposed by the Stations.

The EPA has thoroughly reviewed the SO_2 emission, SO_2 monitoring and meteorological data sets the Stations have proposed to use to model concentrations along the nearby portions of the Laurel Ridge and found them adequate. This satisfies this element of Appendix W.

(iv) Appropriate performance evaluations of the model or technique have shown that the model or technique is not inappropriately biased for regulatory application

The Stations proposed a number of statistical measures to determine if the alternative model using a non-default sigma-v value would provide more realistic concentrations at select monitors on the Laurel Ridge. These statistical measures were outlined in a modeling protocol and the final modeling report and included the following:

- A comparison of model predicted 99th percentile design concentration (predicted and observed) at each monitor and considering all monitors for both the default and alternative model derived concentrations
- Quantile-Quantile (Q-Q) plots of the ranked hourly SO_2 predicted and observed concentrations for monitors along the Laure Ridge using the default and alternative model derived concentrations
- Screening and statistical tests and their statistical measures including Robust Highest Concentrations (RHCs), Fractional Bias (FB)/Absolute Fractional Bias (AFB), Composite Performance Measure (CPM), and Model Comparison Measure (MCM). These are further described in the EPA's Protocol for Determining the Best Performing Model (US EPA, 1992).

The statistical analysis also included using a software package, developed by Sigma Research Corporation and Sonoma Technology, referred to as the Model Evaluation Method (MEM), designed to evaluate model performance by implementing the statistical analysis procedures contained in EPA's Protocol for Determining the Best Performing Model (US EPA, 1992) to assist in the performance measure calculations.

The EPA believes the analysis proposed by the Stations satisfies this Appendix W requirement.

(v) A protocol on methods and procedures to be followed has been established

The EPA reviewed the Stations' alternative model protocol describing the alternative modeling analysis proposed for a portion of the Laurel Ridge within Pennsylvania's Cambria and Westmoreland counties. A modeling protocol, in accordance with sections 3.0 (c) and 9.2.1 (a) of Appendix W, establishes the procedures to be followed, the data to be collected, the model to be used, and the analysis of the source and concentration data to be performed. The final development and acceptance of this modeling protocol is important because it outlines the procedures and databases that will be utilized in the use of the LOW_WIND alternative model option within the EPA's AERMOD air dispersion modeling system and the development of the statistical performance evaluation as discussed in section 3.2.2 (b)(ii) of Appendix W using measured air quality data.

A draft model protocol was originally developed by the Stations in June of 2025 with a final model protocol that addressed all comments made during its review submitted to the EPA on

September 26, 2025. The EPA accepted this final version of the alternative model protocol on September 30, 2025.

The EPA's review and acceptance of this alternative model protocol satisfy this requirement of Appendix W.

Laurel Ridge Modeling Overview

The EPA is providing a brief description of the Stations' development of the default and alternative model analyses used to determine the best performing model for monitors along Laurel Ridge. This includes short summaries of the hourly SO_2 emissions, SO_2 monitoring data and the meteorological data used in the default and LOW_WIND sigma-v simulations. The Penelec study was completed over a one-year period starting on August 1, 1990, and ending on July 31, 1991. A more complete description of model preparation is included in the Stations' model protocol and final modeling reports (Exhibit A and B). Figure 1 displays some of the elements of the Penelec study including the 4 power plants, 10 SO_2 monitoring sites and 1 of the tall met towers (used in the alternative model analysis). Figure 2 shows a roughly west to east cross section (noted in Figure 1) of elevation across the Conemaugh Valley.

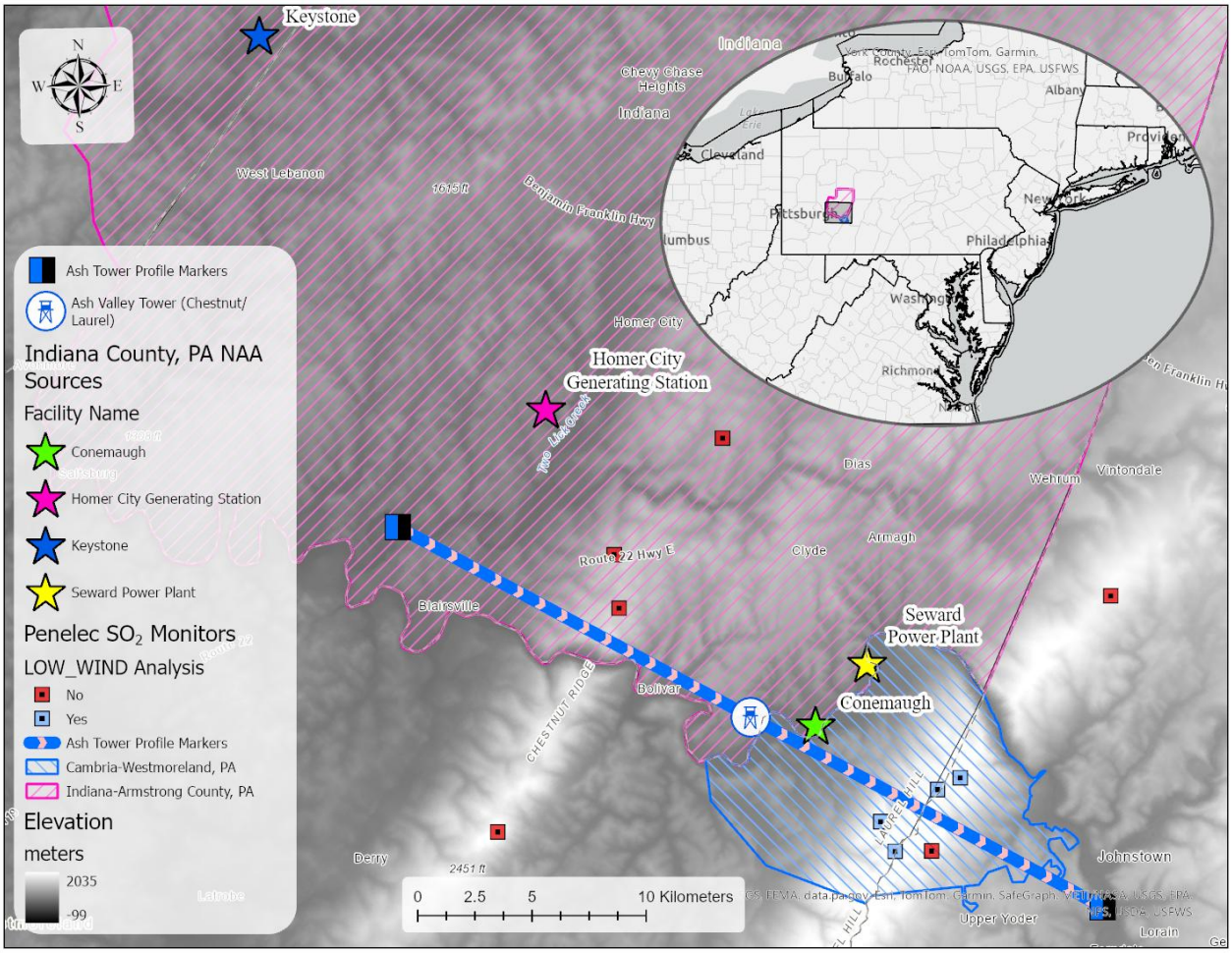

Figure 1. Penelec Study Overview Used in Alternative Model Analysis. ArcGIS Pro 3.6.0 (Esri Inc., 2024).

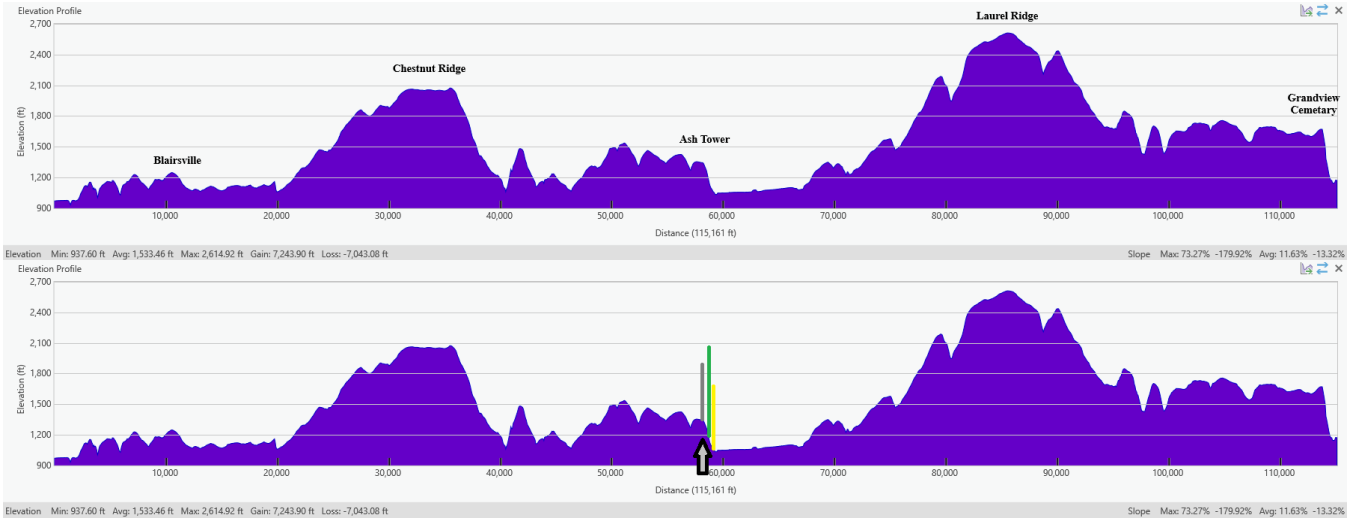

Figure 2. Elevation Cross Section of the Conemaugh Valley. ArcGIS Pro 3.6.0 (Esri Inc., 2024).

Hourly SO_2 Emissions: Hourly emissions from the 4 coal-fired power plants included in the Penelec study were derived through 2 methods. Hourly emissions from the Homer City Generating Station were based on information collected from Continuous Emissions Monitoring Systems or CEMS, which were state of the art at the time. The other 3 power plant hourly emissions were constructed from data collected by the facilities for each boiler. Hourly emission rates were based on 24-hour averaged fuel sampling sulfur content values from the Certified Coal Sampling and Analysis System in combination with heat rates and hourly load data.

The EPA reviewed the original data files to confirm hourly emission rates used in the modeling analysis outside of the Homer City Generating Station (since its hourly emissions were based on CEMS data). It was discovered that hourly emission rates were being generated for days with missing coal sample information. After further review of the data and discussions with all parties, the hourly source emissions were revised to identify hours that were missing crucial coal sample information and then removing them from the final statistical analysis. A total of 7,714 hours over the one-year simulation period were considered valid and were used for the statistical comparison of the default and sigma-v simulated concentrations along the Laurel Ridge.

Hourly SO_2 Monitor Concentrations: The Penelec study supported operating 10 SO_2 monitors along the Chestnut and Laurel ridges. Four monitors on the Laurel Ridge were the primary focus of the alternative model analysis. These included the Baldwin Creek, Powdermill Run, Sugar Run and Terrys Run monitors all located east of the Stations on the Laurel Ridge. Hourly SO_2 concentrations from these 4 monitors were compared to AERMOD default and sigma-v alternative model concentrations.

These 4 monitoring sites were represented in the alternative model analysis by entering each monitor's UTM location into the most recent version of the AMS/EPA Regulatory Model Terrain Pre-processor (AERMAP), a preprocessor of the EPA's AERMOD system. The current version of AERMAP (version 24142) was used to extract monitor elevation and hill height scale, which is used to calculate the critical dividing streamline height, for each of the Laurel Ridge SO_2 monitors. Extraction of this data was completed following the EPA's AERMAP users guide (US EPA, 2024c) using National Elevation Dataset (NED) data in GeoTIFF format obtained from the US Geological Survey (USGS) downloaded (July 2025) via The National Map Download Tool.

Meteorological Data and AERMET Preprocessing: The Penelec study included wind and temperature data collected at 2 tall tower locations. Meteorological data collected at the Ash Valley (150-meter) tower located several kilometers west of the Stations was used for the alternative model analysis. Ash Valley included wind direction and wind speed data collected at 10-meters, 50-meters, 89-meters and 150-meters, standard deviation of horizontal wind direction or sigma-theta at 10-meters and temperature at 10-meters. Hourly cloud cover and surface pressure measurements and twice daily upper air soundings from Pittsburgh International Airport supplemented the site-specific data from the Ash Valley met tower. Missing hours in the Ash Valley data were preserved from the original data since the requirement to fill missing hours is not necessary with the current version of the EPA's AERMOD dispersion model. At the time of the Penelec study, air dispersion models required all hours to be filled.

The meteorological data used in the alternative model analysis were processed using the EPA's AERMET preprocessor (US EPA, 2024d) to produce the default and sigma-v AERMOD ready inputs. AERMET requires specification of site characteristics including surface roughness (z_0), albedo (r), and Bowen ratio (B_0). These parameters were developed in accordance with the most recent version (November 2024) of the EPA's AERMOD Implementation Guide (US EPA 2024e).

Development of the final AERMET files was done using the EPA's AERSURFACE tool (US EPA, 2024f). This tool assists users in obtaining realistic and reproducible surface characteristic values for albedo, Bowen ratio, and surface roughness length, for input into AERMET. The tool uses data from the National Land Cover Database (NLCD) from the USGS and look-up tables of surface characteristic values that vary by land cover type and season. These seasonally varying surface characteristics were developed to reflect conditions at the time of the Penelec study and consider land use, precipitation and snow cover information.

Final AERMOD ready meteorological input files for both the default and sigma-v alternative model simulations were processed with dates reflecting 1990 even though the Penelec study period extended into 1991. This is a relic of the original TRC processing and reflects model requirements of the early 1990s when full calendar years were necessary. While corrective dates were considered, in the end the original Penelec study dates were preserved to allow for processing of the upper air data from the study's original record. These date misrepresentations (full 1990) do not impact the final model analysis.

After a thorough review of the meteorological inputs and final processed model-ready files, the EPA believes the meteorological input files were prepared in accordance with all applicable guidance.

Statistical Comparison of Default and LOW_WIND Laurel Ridge Monitor Model Concentrations

As noted previously, the final model analysis includes 7,714 valid hours from the Penelec study period. Model performance statistics, detailed in full in the Stations' Exhibit B, were done by comparing the default and alternative model, with sigma-v set to 0.5 m/s, for the 4 Laurel Ridge SO_2 monitors. The Stations model performance statistics were completed for each individual monitor and the combined results for all 4 Laurel Ridge monitors.

Model performance was gauged following the EPA's 1992 guidance and was based on the observed and predicted highest 25 values (unpaired in time) for each of the 4 Laurel Ridge monitors and the collective values of all 4 Laurel Ridge monitors. In general, the Stations analysis indicates modest improvement, but no bias towards underprediction, when using the alternative sigma-v processed simulations versus the default simulations.

The EPA independently verified the Stations' top 25 values taken from the 7,714 valid hours both individually and collectively for the 4 Laurel Ridge SO_2 monitors. Summary statistics including Robust Highest Concentrations (RHCs), Fractional Bias (FB)/Absolute Fractional Bias (AFB), Composite Performance Measure (CPM), and Model Comparison Measure (MCM) from the Stations' final report (Exhibit B) were verified by the EPA.

A full description of the Stations' model performance analysis is available in its final report (Exhibit B). The EPA will present a few results in this concurrence request memo, including Quintile-Quintile results for the Laurel Ridge monitors, fractional bias results, and the Model Comparison Measure at the 90% confidence interval.

Q-Q Plot for Combined Laurel Ridge Monitors: A Quantile-Quantile (Q-Q) plot is a graphical tool used to assess if a dataset follows a specific theoretical distribution (often normal) by plotting the quantiles of the sample data against the corresponding quantiles of the target distribution.

Figure 3 displays the Q-Q plot for the combined Laurel Ridge monitor results for the default and the alternative model sigma-v (set to 0.5 m/s) simulations. Lines depicting the 2:1, 1:1 and 1:2 lines are included on the graph and are meant to show the expected range of modeled to observed concentration ratios.

The figure shows both model simulations tend to overpredict concentrations with results falling near the 2:1 (model to observed) line for the combined Laurel Ridge monitors. There is, however, a slight improvement using the alternative model over the default. The Q-Q plot also suggests using the alternative model doesn't provide any biased underprediction in the peak range of predicted model concentrations with values in the peak model range well above the 1:1 line.

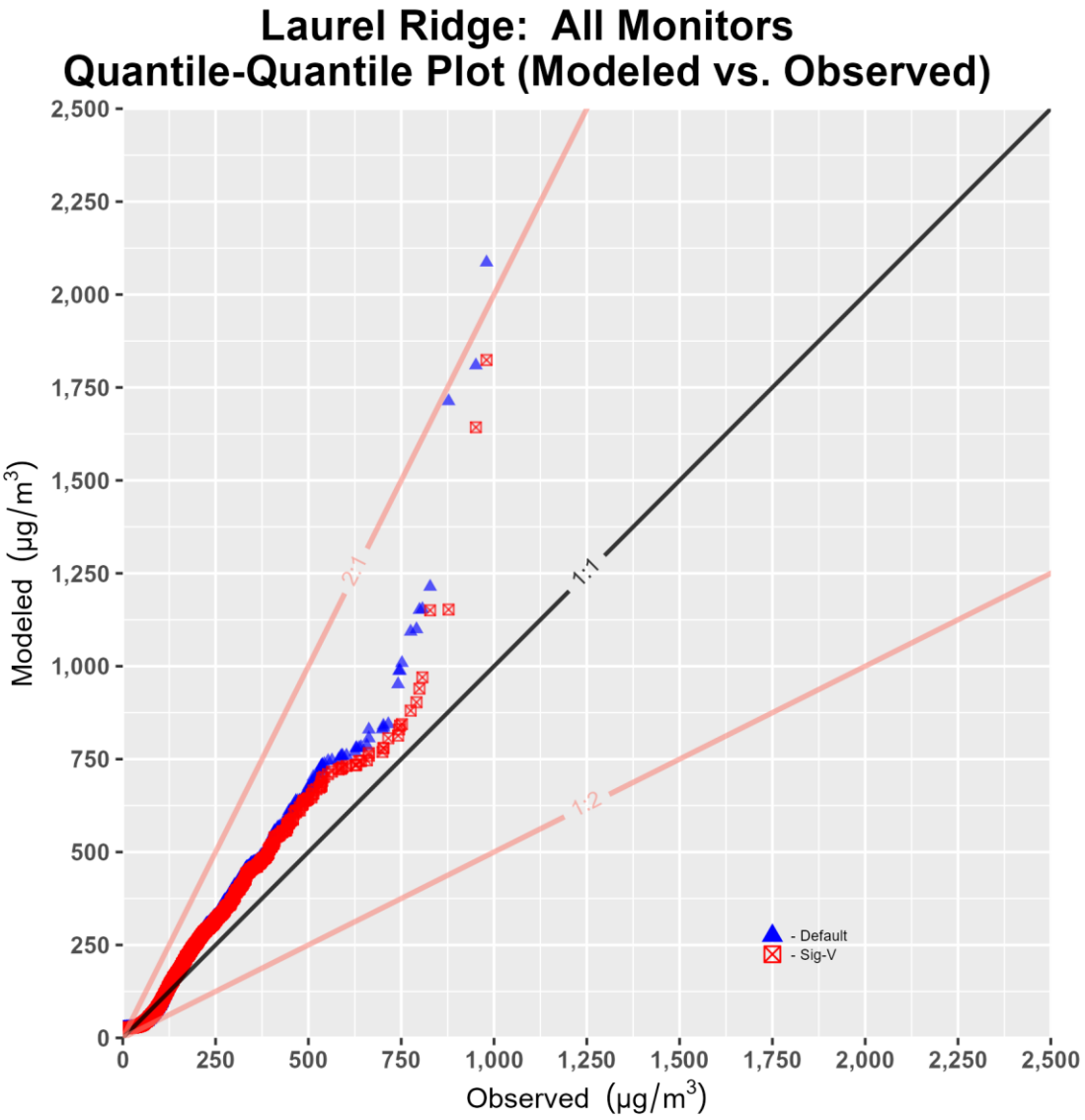

Figure 3. Q-Q Plot for Combined Laurel Ridge Monitors.

Model Bias Analysis: Following the EPA's model performance protocol (US EPA, 1992), a graphical illustration of model performance in which the fractional bias of the standard deviation (y-axis) is plotted against the fractional bias of the average (x-axis) was performed with concentrations from the default and alternative model sigma-v simulations. In this depiction, models that plot close to the center of the graph (0,0) are relatively free from bias, while models that plot further away from the center tend to over or underpredict. Values of the fractional bias that are equal to -0.67 are equivalent to overpredictions by a factor-of-two, while values that are equal to +0.67 are equivalent to underpredictions by a factor-of-two.

Figure 4 shows plots of the fractional bias scores for each of the four Laurel Ridge monitors and the results for all four Laurel Ridge monitors combined for both the default and LOW_WIND sigma-v options. Bias values for the alternative model sigma-v simulations are closer to the origin (green dot on figure) than the default simulations. We also note more monitors fall within the red box (fractional bias scores within a factor of 2) for the alternative sigma-v setting simulations. This indicates an improvement in the alternative model performance over the default model.

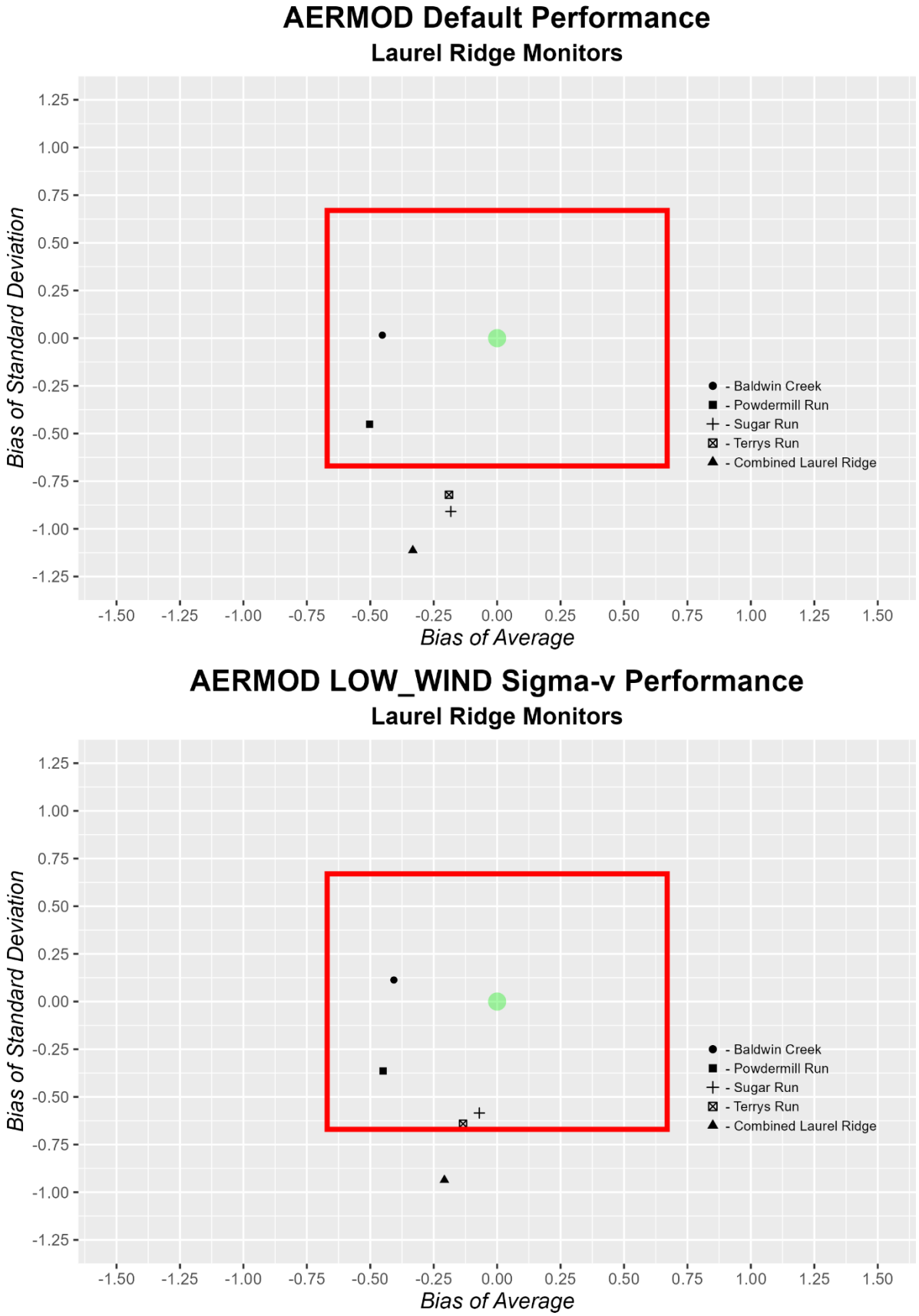

Figure 4. Model Performance Based on Fractional Bias Values.

Model Comparison Measure Results: The Model Comparison Measure or MCM also indicates improved model performance using the alternative model sigma-v setting. The MCM result for each monitor is approximately equal to the Composite Performance Measure or CPM for the default minus the alternative. A positive result for the MCM indicates that the alternative model has a better performance than the default model, and a negative result indicates that performance of the default model is better.

Figure 5 shows the MCM values at the 90% confidence interval. The MCM values are positive for all 4 monitors, indicating the alternative model's consistently better performance. For the overall combined model comparison measure (CMCM), the alternative model performance meets the criteria for showing a statistically significant improvement over the default model within a 90% confidence interval, as the range of the confidence interval does not cross zero (green shading in figure).

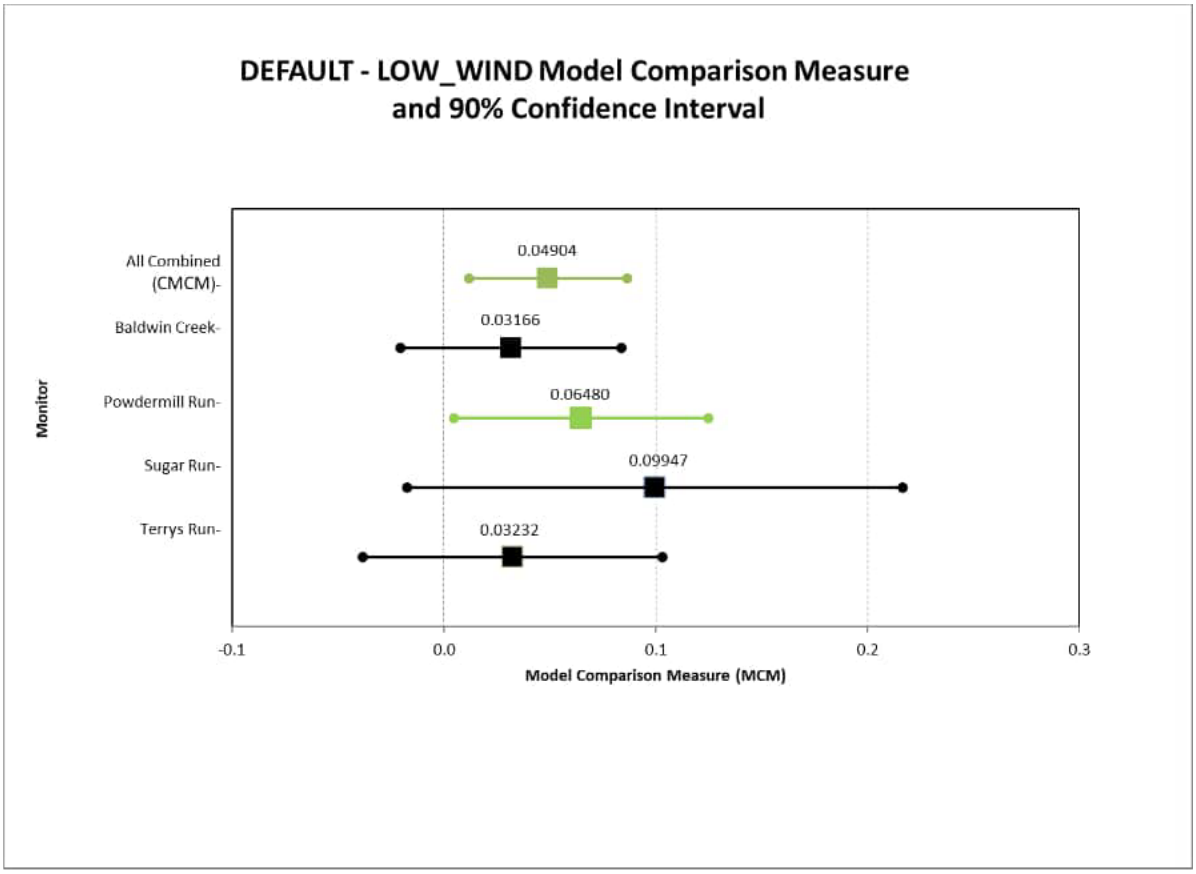

Figure 5. Model Comparison Measure Results Using Sigma-v (0.5 m/s). From Exhibit B, AECOM Final Report.

Conclusion

AECOM and the Stations completed a model performance analysis as part of an alternative model request under section 3.2.2 (b) of Appendix W. As part of this request, the alternative model justification followed all 5 elements listed in section 3.2.2(e)(i-v) of Appendix W. The Stations' model performance analysis showed a modest and statistically significant improvement, but no bias towards underprediction, using a modified value of sigma-v (0.5 m/s) via AERMOD's LOW_WIND option versus AERMOD's default settings.

Based on this result, the EPA Region 3's Regional Administrator has approved the Stations alternative model request. In accordance with Appendix W, we ask concurrence from the Model Clearinghouse for this case-specific alternative model request at your earliest convenience.

References

Chowdhury, B., R. I. Sykes, D. Henn, P. Karamchandani, 2016. SCICHEM Version 3.0 Technical Documentation.

Esri Inc., 2024. ArcGIS Pro, (Version 3.6.0) [Software]. Redlands, CA: Esri Inc.

Hanna, S. R., 1983: Lateral turbulence intensity and plume meandering during stable conditions. Journal of Applied Meteorology., 22, 1424-1430.

Hanna, S.R., 1990. Lateral dispersion in light-wind stable conditions. Il Nuovo Cimento C 13, 889–894. https://doi.org/10.1007/BF02514777

Mahrt, L. Stratified Atmospheric Boundary Layers and Breakdown of Models. Theoretical and Computational Fluid Dynamics 11, 263–279 (1998).

R Core Team, 2025. _R: A Language and Environment for Statistical Computing_. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>.

Smedman, A. S., 1988. Observations of a multi-level turbulence structure in a very stable atmospheric boundary layer. Boundary-Layer Meteorology, 44, 231–253. https://doi.org/10.1007/BF00116064

The US EPA, 2024a, AERMOD Model Formulation, EPA-454/B-24-010, November 2024.

The US EPA, 2024b, User's Guide for the AMS/EPA Regulatory Model (AERMOD), EPA-454/B-24-007 November 2024.

The US EPA, 2024c, User's Guide for the AERMOD Terrain Preprocessor (AERMAP), EPA-454/B-24-008, November 2024.

The US EPA, 2024d, User's Guide for AERMOD Meteorological Preprocessor (AERMET), EPA-454/B-24-004, November 2024.

The US EPA, 2024e, AERMOD Implementation Guide, EPA-454/B-24-009, November 2024.

The US EPA, 2024f, User's Guide for AERSURFACE Tool, EPA-454/B-24-003 November 2024.

The US EPA, 2014, Guidance for 1-Hour SO_2 Nonattainment Area SIP Submissions. Memo from Stephen Page to Regional Air Division Directors, April 23, 2014.

The US EPA, 1992. Protocol For Determining Best Performing Model, Office of Air Quality Planning and Standards Research Triangle Park, EPA-454/R-92-025, September 1992.

Enclosures

cc: Michael Dunn, Acting Director, Air & Radiation Division
Michael Gordon, Branch Chief, Planning and Implementation Branch