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Memo

To	Andrew Fleck - PADEP
From	Tom Wickstrom - ERM
Date	27 February 2023
Reference	Air Quality Analysis for Prevention of Significant Deterioration
Subject	Response to DEP Comments

Dear Mr. Fleck:

Thank you for your review and comment on the air quality analysis submitted to PADEP on behalf of Energy Transfer Marketing & Terminals, L.P. (Energy Transfer). Below are responses to each of your comments received in your August 12, 2022 comment document submitted to Energy Transfer. A revised air quality modelling report is also being provided with these responses.

APPENDIX F

1. **The title of Appendix F should be "NO2, CO, & PM-2.5 Air Dispersion Modeling Report." All references to Appendix F in the application should be revised accordingly**

The title of Appendix F has been revised to "NO2, CO, & PM-2.5 Air Dispersion Modeling Report." All references in the application were updated to reflect this update.

PROJECT SOURCES (2.2.1)

2. **The source base elevations in the AERMOD input files differ slightly from those entered in the BPIPPRM input file, those generated by the AERMOD terrain preprocessor (AERMAP) in the "ETP.SOU" file, and those listed in the Attachment C (Model Source Information). These differences are listed in the table below.**

Comparison of Source Base Elevations

Source	AERMOD Input (m)	BPIPPRM Input (m)	ETP.SOU File (m)	Attachment C (m)
B031	6.93	6.93	7.16	6.82
WWF	2.44	2.97	3.44	3.27
ME1CF_LP	3.35	3.47	3.40	3.40
ME1CF_HP	3.35	3.47	3.40	3.40
ME2CF_LP	3.05	5.44	6.36	2.59
ME2XCFLP	6.10	5.40	5.33	5.49
ME2XCFHP	6.10	5.40	5.33	5.49
152BCTC1	3.50	3.50	3.57	3.54
152BCTC2	3.53	3.53	3.57	3.54
152BCTC3	3.51	3.51	3.56	3.50

Source	AERMOD Input (m)	BPIPPRM Input (m)	ETP.SOU File (m)	Attachment C (m)
152BCTC4	3.53	3.53	3.54	3.48
152BCTC5	3.51	3.51	3.62	3.48
152BCTC6	3.48	3.48	3.57	3.47
230119C1	3.01	3.01	3.35	2.87
230119C2	3.19	3.19	3.34	2.94
230119C3	3.32	3.32	3.31	2.95
230119D1	2.94	2.94	3.02	2.98
230119D2	2.88	2.88	2.92	2.87
230119D3	2.91	2.91	2.85	2.87
1WSAC1	3.82	3.82	3.65	3.63
1WSAC2	3.71	3.71	3.64	3.76
1WSAC3	4.11	4.11	3.75	3.78
1WSAC4	4.83	4.83	3.94	4.00
1WSAC5	5.48	5.48	4.24	4.44
2WSAC1	3.41	3.41	3.47	3.38
2WSAC2	3.36	3.36	3.36	3.33
2WSAC3	3.47	3.47	3.36	3.37
2WSAC4	3.79	3.79	3.38	3.53
2WSAC5	4.15	4.15	3.44	3.41

The correct set of base elevations is in the ETP.SOU column above. The base elevations were fixed in the BPIP downwash analysis run as well as the AERMOD runs.

3. The source of the stack heights in the table in Attachment C should be documented for all sources.

The table in Attachment C was updated to include the sources of stack heights for all sources.

4. The table in Attachment C should include a column or footnote with the actual flare stack heights (Hs) used in the effective stack height calculations the same way footnote "c" provides the total heat release rates. Also, the following flare stack heights are entered in the BPIPPRM input file: WWF – 60.81 meters (199.5 feet), ME1CF_LP and ME1CF_HP – 36.58 meters (120 feet), ME2CF_LP – 76.20 meters (250 feet), and ME2XCFLP and ME2XCFHP – 59.44 meters (195 feet). Using the formulas below from the AERSCREEN User's Guide and referenced in footnote "b", different effective stack heights from what is listed in the table would be calculated from the stack heights entered in the BPIPPRM input file.

$$D = 9.88 \times 10^{-4} \times \sqrt{HR \times (1 - HL)} \quad (1)$$

$$h_{eff} = H_s + 4.56 \times 10^{-3} \times HR^{0.478} \quad (2)$$

Where D is effective stack diameter, HR is the heat release rate, HL is the heat loss fraction, H_{eff} is effective stack height and H_s is the stack height entered by the user.

The actual stack heights are correct in the BPIP input file. The effective stack heights for the flares were updated to correctly calculate the effective stack height using the guidance from the AERSCREEN User's Guide.

5. The source of the stack diameters in the table in Attachment C should be documented for all sources. Footnote "a" is not marked in the table for the B031/B033/B034 source. Also, the source of the total heat release rates in footnote "c", used in the effective stack diameter calculations for the flares, should be documented.

See response to comment #3 for sources of diameters. Footnote "a" was added to the B031/B033/B034 source table items in Attachment C. Heat release for flares is based on the sum of heating values for pilot, sweep, operational, and maintenance flows.

6. The source of the stack exit temperatures in the table in Attachment C should be documented for all sources. In particular, how was a single value of 425.37 K for all scenarios for the B031/B033/B034 source determined and how was a value of "0" for the cooling units determined so that AERMOD adjusts the exit temperature to match the ambient temperature?

The stack temperature for the boilers was determined using stack test data collected for all 3 boilers and the cooling tower exhaust was conservatively assumed to match the ambient temperature. Attachment C was updated to reflect this and the 2018 and 2021 stack test reports are included in Appendix I. Additional information related to the boiler stack temperatures is included in the response to Comment 7 below.

7. The source of the stack exit velocities in the table in Attachment C should be documented for all sources. In particular, how were the stack exit velocities for the different scenarios for the B031/B033/B034 source determined and how were the stack exit velocities for the cooling units determined?

As described in the air quality modeling report, the individual boiler flues are all co-located in the same bundled stack. Therefore, ETMT calculated an effective stack diameter for scenarios where more than one boiler is in operation to account for the combined effect of buoyancy and momentum-induced plume rise from the adjacent plume releases.

The stack exhaust exit velocities and temperatures for the boilers were calculated based on stack test results. A summary of the three run average volumetric exhaust flow rates and temperatures from the stack tests for the three boilers are summarized below. Each of the tests was conducted at the full firing rate of the boilers.

Boiler	Stack Test Date	Three Run Average Volumetric Flow Rate (acfm)	Three Run Average Temperature (°F)
Auxiliary Boiler 1	8/6/2021	98,429	312.7
Auxiliary Boiler 3	12/20/2018	114,422	334.4
Auxiliary Boiler 4	12/20/2018	107,363	321.2

As described in the air quality modeling report, a total of nine (9) boiler scenarios were modeled. There are three boiler operation scenarios (one boiler in operation, two boilers in operation, three boilers in operation) along with three boiler load scenarios (100%, 75%, and 50% loads), resulting in nine total scenarios.

To ensure conservative model results, the flow and temperature for Auxiliary Boiler 1 were used in the calculations of exit velocity for the single boiler operation scenarios, since this boiler had the lowest flow and temperature indicated in the stack tests. Similarly, for the two boiler operation scenarios, the flow and temperatures from Auxiliary Boilers 1 and 4 were used, as that is that combination of boilers that results in the lowest overall exhaust flow and temperature.

Example calculations are provided below. These calculations are for the 100% boiler load scenarios. It should be noted that the 75% and 50% load scenarios were accounted for by applying a 0.75 and 0.50 adjustment factor to the calculated exit velocity, respectively, to account for the decreased exhaust flow at lower boiler loads. It should also be noted that each boiler flue has an inner stack diameter of 6.4 ft., as determined by the onsite survey.

Single Boiler Scenario Exit Velocity:

As stated previously, for the single boiler scenario the exhaust parameters for Auxiliary Boiler 1 were assumed. The exit velocity is simply calculated using the exhaust flow rate and flue inner diameter as follows:

$$\frac{Flow}{Area} = Exit\ Velocity$$

$$98{,}429\ \mathrm{ft^3}/_{min} * \frac{\mathrm{min}}{60\ \mathrm{s}} * \frac{1}{(\pi * (3.2\ ft)^2)} = 50.99\ ft/s$$

To calculate the exit velocity for the two and three boiler operation scenarios, an equivalent diameter approach was used. The equation above was used to solve for an equivalent area of the stack by substituting the higher flow rates for the two and three boiler operation scenarios in the equation and keeping the exit velocity of 50.99 ft/s constant as illustrated below.

Two Boiler Scenario Equivalent Diameter:

The total flow for the two boiler scenario is equal to the sum of the flows from Auxiliary Boiler 1 and 4 (98,429 acfm + 107,363 acfm = 205,792 acfm). Therefore,

$$\frac{205{,}792\ \mathrm{ft^3}/_{min}}{50.99\frac{ft}{s} * 60\frac{s}{min}} = \mathrm{Area}\ (ft^2) = 67.26\ ft^2$$

and,

$$2 * \sqrt{\frac{67.26\ ft^2}{\pi}} = Diameter\ (ft) = 9.25\ ft$$

The equivalent diameter for the three boiler operation scenario was calculated similarly using the full volumetric flow rate from all three boilers of 320,214 acfm.

Two Boiler Scenario Exhaust Temperature:

For temperature, the two and three boiler scenarios used a combined temperature that weighted the individual stack test temperatures by the stack test volumetric flow rates. Using the temperatures and flows from the stack test data for Auxiliary Boiler 1 and 4 results in the following weighted average exhaust temperature of the combined boiler exhaust:

$$\frac{312.7\,°F * 98{,}429\,acfm + 321.2\,°F * 107{,}363\,acfm}{98{,}429\,acfm + 107{,}363\,acfm} = 317.13\,°F$$

The exhaust temperature for the three-boiler scenario was calculated similarly.

Exit velocities for the cooling units were calculated using the measured diameter from surveyor data with the exception of the wet surface air coolers. All flow data and the diameters for the wet surface air coolers were obtained from engineering drawings. Footnotes were added to Attachment C to document the data sources and all drawings are included in Appendix I.

8. The source of the emission rates in the table in Attachment C should be documented for all sources. The emission rates entered in AERMOD do not appear to relate to the emissions calculations in Appendix D (Detailed Emissions Calculations). Calculations used to determine the emission rates entered in AERMOD should be provided. Additionally, please clarify why the short-term and annual emission rates for the B031/B033/B034 source are identical for NOX and CO, but differ for PM-2.5. Also, the "CO Annual Emission Rate" column seems unnecessary since there is not an annual National Ambient Air Quality Standard (NAAQS) for CO.

An updated table was provided which denotes sources for each emission rate shown in Attachment C.

BUILDING WAKE EFFECTS (2.3)

9. This subsection should include a reference to Attachment B (Facility Layout) which contains the "Source Point and Downwash Area Modeling" imagery.

A reference to Attachment B was added to Section 2.3.

10. The BPIPPRM input file should be updated to reflect any changes to the facility layout associated with the sources authorized in Plan Approval 23-0119J. For example, the location of downwash structure "BLD_4" (Bldg 854) overlaps with the locations of the 2WSAC1 and 2WSAC2 (Wet Surface Air Cooler) sources. Additionally, two new tanks to be installed under Plan Approval 23-0119J are not included in the BPIPPRM input file and are not depicted in Attachment B. Also, a building to the west of the 1WSAC and 2WSAC sources and southwest of the ME2XCFLP (ME-2x ColdFlare LP) and ME2XCFHP (ME-2x ColdFlare HP) sources was not included in the BPIPPRM input file.

The BPIPPRM input file was updated to include the two planned tanks and the building to the west of the WSACs. BLD_4 was removed from the BPIPPRM input file.

11. Downwash structures "TANK_5" (522) and "TANK_6" (390) are both included in the BPIPPRM input file and appear in Attachment B. However, the March 2020 renewal of the Title V Operating Permit 23-00119 notes the removal of both structures. Therefore, the BPIPPRM input file and Attachment B should be updated.

Tank 5 and Tank 6 were removed in the updated BPIPPRM input file.

12. In the BPIPPRM input file, the stack heights entered for the 152BCTC1 through 152BCTC6 (15-2B Cooling Tower Cell 1 through 6) sources are 6.10 meters and the height entered for the associated structure "44" (15-2B CT) is 13.80 meters. Aerial imagery indicates that the stack heights should be greater than the height of the associated structure. Also, the coordinates of these sources do not appear to align with the coordinates of the associated structure.

The stack heights for the 15-2B Cooling Tower were updated with the as-built heights of the cooling cells and associated structure.

13. In the BPIPPRM input file, the stack height, 36.58 meters (120 feet), entered for the ME1CF_LP (ME-1 ColdFlareLP) and ME1CF_HP (ME-1 ColdFlare HP) sources does not match the stack height, 30 feet (9.144 meters), listed for these sources (Flares – C01 Cold Flare (Source ID: C01)) on the forms in Appendix A (PADEP Plan Approval Forms).

As detailed in the response to Comment #3, the ME1CF height has been revised to match the as-built height of the structure.

14. Appendix B (Plot Plan) highlights the locations of the new refrigeration train (Train D) and Boil Off Gas (BOG) system. Do either of these locations contain structures that should be included in the BPIPPRM input file as well as Attachment B?

TANK_5 and TANK_6 were removed, BLD_60 and BLD_61 were added to the BPIPPRM input file and to Attachment B.

MODEL SELECTION AND APPLICATION (3.1)

15. If warranted, ETMT should consider using AERMOD v22112, released by the U.S. Environmental Protection Agency (EPA) on June 27, 2022, in responding to these comments.

The revised modeling analysis presented in the updated modeling report used AERMOD and AERMET v22112.

SIGNIFICANT IMPACT ANALYSIS MODELING PROCEDURES (3.1.1.1)

16. Figure II-2 of the EPA's "Guidance for Ozone and Fine Particulate Matter Permit Modeling" (EPA-454/R-22-005, July 2022) is a flowchart that provides an overview of the PM-2.5 Prevention of Significant Deterioration (PSD) increments compliance demonstration.
The decision diamond "Major Source Construction Since Major Source Baseline Date?" (Yes or No) has not been determined by the DEP. Therefore, in addition to assuming "No" and proceeding to the decision diamond "Source Impact Above Increment?" (as was done in this analysis), ETMT should also assume "Yes" and proceed to the decision diamond "Source Impact Greater Than or Equal to SIL?". That being said, the methodology stated in this subsection, "the high-1st-high value averaged at each receptor over 5 years is compared to the applicable SILs" is appropriate in the 24-hour PM-2.5 and

annual PM-2.5 significant impact level (SIL) analyses relative to the PM-2.5 NAAQS. However, concentrations should not be averaged over the 5 years in the 24-hour PM-2.5 and annual PM-2.5 SIL analyses relative to the PM-2.5 PSD increments.

In the 24-hour PM-2.5 SIL analysis for the Class II PSD increment, the model input files for the 24-hour PM-2.5 SIL analysis for the NAAQS could be used, but the H1H keyword should be utilized in AERMOD's control (CO) pathway to "turn off" the averaging of concentrations before executing AERMOD for each scenario. As an alternative to executing AERMOD for the 24-hour PM-2.5 SIL analysis for the Class II PSD increment, the AERMOD plot (.PLT) files for the 24-hour PM-2.5 SIL analysis for the NAAQS could be examined to determine the maximum 24-hour average concentration within the 5 years for each scenario. In the annual PM-2.5 SIL analysis for the Class II PSD increment, the model input files for the annual PM-2.5 SIL analysis for the NAAQS could be used, but AERMOD should be executed separately for each year to determine the maximum annual average concentration within the 5 years for each scenario.

Also, this comment relates to comments 27 and 28 regarding model results.

An additional set of results was added to table 4-2 reporting the maximum high-1st-high concentration in the 5-year period for both the 24-hr and annual averaging periods. The additional input files are being provided to DEP.

17. In Table 3-1, the following revisions should be made:

- **Reference to footnote "g" should also follow the primary annual PM-2.5 NAAQS;**
- **Reference to an additional footnote for 40 CFR 51.165(b)(2) should follow the 1-hour CO, 8-hour CO, and annual NO2 Class II SILs;**
- **Reference to an additional footnote for EPA's April 17, 2018, memorandum, "Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program" should follow the 24-hour and annual PM-2.5 Class II SILs; and**
- **Reference to an additional footnote for 40 CFR § 52.21(i)(5)(i) should follow the annual NO2 and 8-hour CO SMCs.**

Table 3-1 was updated with the appropriate references.

EFFECTS ON GROWTH, SOILS, VEGETATION, AND VISIBILITY (3.3.3)

18. In Table 3-7, how were the project emissions calculated for each compound and which sources at the facility emit these compounds? Also, boron and fluoride are both listed in Table 5-7 of EPA's "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals" (EPA 450/2-81-078, December 12, 1980). Why were project emissions for these compounds omitted?

Project emissions represent boiler combustion emissions calculated using the boiler heat input and emission factors from EPA's AP 42, Fifth Edition, Volume I Chapter 1: External Combustion Sources, Section 1.4 – Table 1.4-4. Boron and Fluoride are omitted from this analysis because no emission factor for those compounds is available for natural gas combustion.

RECEPTOR GRIDS (3.4)

19. The "ETP_25km_10m.ROU" file, called by the receptor (RE) pathway of the AERMOD input files in the "Class II SIL", "PM2.5 Class II Increment", and "Soils and Vegetation" analyses, and the AERMAP files associated with the processing of this file were not included in the "electronic modeling archive." The AERMAP folder in the "electronic modeling archive" includes files associated with the processing of 4,101 model receptors, but the AERMOD output files indicate that 8,653 model receptors were used.

The "ETP_25km_10m.ROU" file was provided to PADEP when requested after the submission of the modeling report. However, as described in the response to comment 20 below, a new receptor grid file was generated that includes additional receptors placed along right of way traversing the facility property.

20. The segments of Blueball Avenue and the Northeast Corridor train line that run through the facility's property should be considered "ambient air" and include model receptors. See the EPA's December 2, 2019, memorandum, "Revised Policy on Exclusions from "Ambient Air"." Receptors were added to Blueball Avenue and along the train line in the revised modeling analysis.

METEOROLOGICAL DATA FOR AIR QUALITY MODELING (3.5)

21. The DEP has reprocessed the Philadelphia International Airport (KPHL) 2016-2020 meteorological dataset using AERMET v22112, released by the EPA on June 27, 2022. If warranted, ETMT should consider using this updated KPHL meteorological dataset in responding to these comments. The DEP will provide the updated KPHL meteorological dataset upon request. The DEP notes the following revisions in the updated KPHL meteorological dataset:

In the Washington Dulles International Airport (KIAD) upper air data file in the Forecast Systems Laboratory (FSL) format, a "Line 9" with missing data codes (i.e., 9 99999 85 99999 99999 99999 99999") was added where the first level of the 12Z measurements was not a type 9 as listed in the AERMET Stage 1 messages file (W31 warning). These additional lines were added to the 12Z measurements for the following dates: 6 APR 2017, 8 JUL 2017, 13 JUL 2017, and 19 AUG 2017. This enables AERMET to read the 12Z measurements and calculate convective boundary layer parameters for these dates, therefore improving the meteorological data completeness. The DEP revised its meteorological dataset completeness documentation which ETMT may want to include as Attachment F (Meteorological Data Completeness – KPHL – 2016-2020);

In AERSURFACE, more recent (since the DEP's last processing of the KPHL meteorological dataset on June 2, 2021) land cover and impervious surface data for 2016 from the U.S. Geological Survey's (USGS) National Land Cover Dataset (NLCD) was utilized; and

In AERSURFACE, the user-defined sector definitions for the surface roughness length study area were revised based on the more recent land cover and impervious surface data for 2016. Sector 5 was revised from 200-260 degrees to 200-230 degrees and sector 6 was revised from 260-330 degrees to 230-330 degrees.

The updated meteorological data generated by PADEP using AERMET 22112 was used in the revised modeling analysis.

METEOROLOGICAL DATA REPRESENTATIVENESS (3.5.3)

22. This subsection should reference Attachment G (Location of KPHL ASOS Station and Project Site) instead of Attachment H.

The reference in Section 3.5.3 was corrected to refer to Attachment G.

REPRESENTATIVENESS OF SURFACE CHARACTERISTICS (3.5.3.1)

23. This subsection should reference Attachment H (Micrometeorological Variables Comparison KPHL Airport and Project Site) instead of Attachment I (which does not exist).

The reference in Section 3.5.3.1 was corrected to refer to Attachment H.

24. Please include the KPHL meteorological data processed with the site-derived surface characteristics in the "electronic modeling archive" as indicated by the last sentence in this subsection. The data should include the "AERMOD-ready" surface (.sfc) and profile (.pfl) files as well as all AERMET and AERSURFACE files associated with the processing of these files.

The requested meteorological data has been included in the updated modeling archive that was generated using the site-derived surface characteristics, along with the files used to process the data.

CLASS I IMPACTS (3.6)

25. This subsection should include the calculation of Q. Subsection 3.2 of the "Federal Land Managers' Air Quality Related Values Work Group (FLAG): Phase I Report – Revised (2010)" defines Q as the "total SO2, NOX, PM10, and H2SO4 annual emissions (in tons per year, based on 24-hour maximum allowable emissions." A footnote should be added to Table 3-8 (Distances to Class I Areas and Q/D Values) with the value of Q.

Table 3-8 was revised to include the values of Q used to calculate Q/D that are based on short-term emission rates expressed as tons per year.

26. This subsection states, "SPMT will notify Federal Land Managers (FLM's) of the proposed project and will provide them with the Q/D analysis." Please provide copies of these communications with the FLMs of the U.S. Fish and Wildlife Service, National Park Service, and U.S. Forest Service. These communications and FLM responses should be included as an additional attachment.

Communications with the Federal Land Managers (FLM's) are included as an additional attachment within the modeling archive.

CLASS II SIL ANALYSIS RESULTS (4.1)

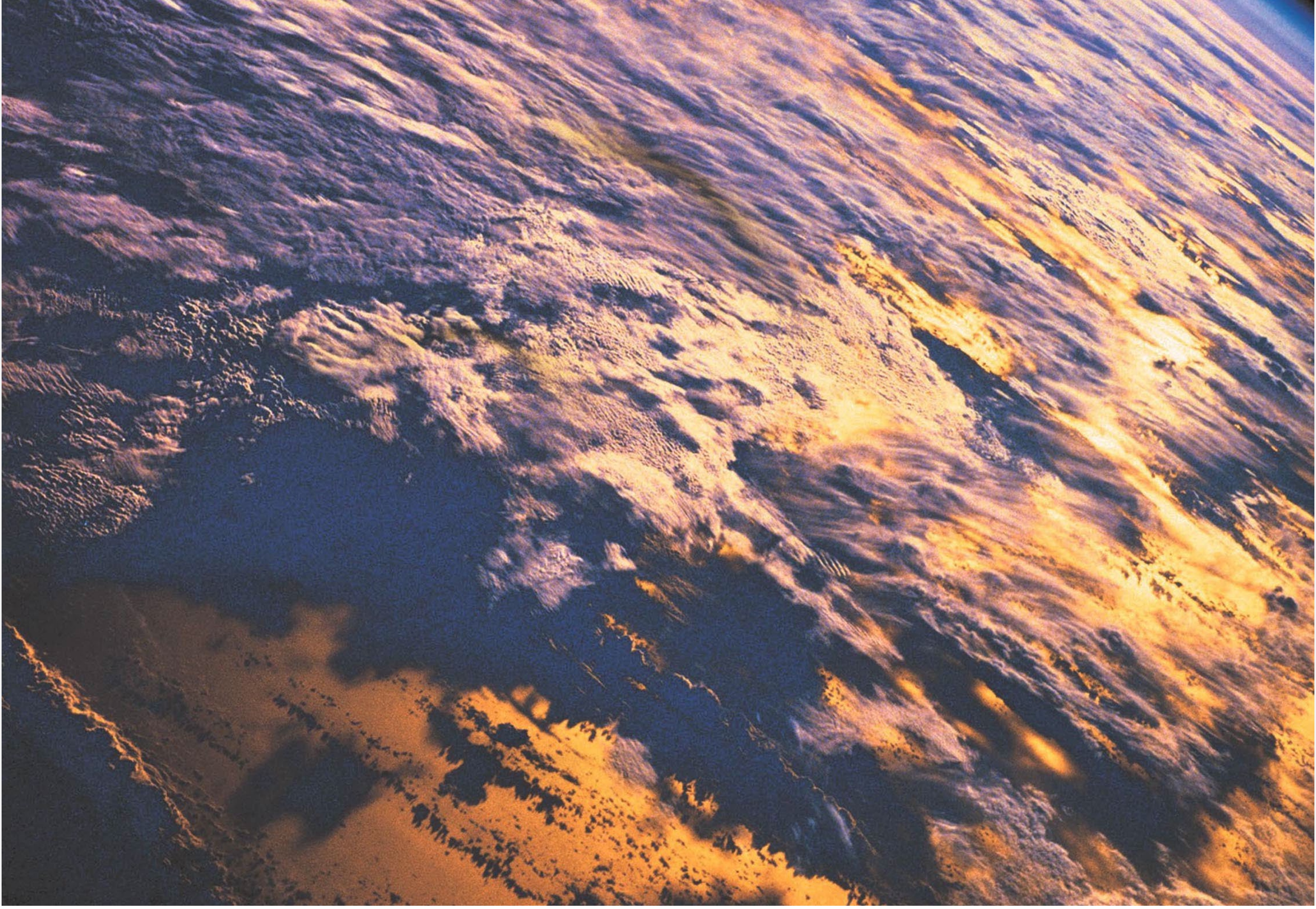
27. This subsection should also include a table that presents the results of the 24-hour PM-2.5 and annual PM-2.5 SIL analyses for the Class II PSD increments for all the scenarios evaluated. See comment 16.

The results for the 24-hr and annual PM-2.5 SIL analyses for the Class II PSD Increments were added to Table 4-2 in the results section.

CLASS II PM2.5 INCREMENT ANALYSIS RESULTS (4.2)

28. Table 4-4 should be revised to include the maximum 2nd-high 24-hour PM-2.5 concentration and maximum annual PM-2.5 concentration based on the scenario(s) which yields the maximum 24-hour PM-2.5 concentration and maximum annual PM-2.5 concentration in the 24-hour PM-2.5 and annual PM-2.5 SIL analyses for the Class II PSD increments, respectively. See comment 16.

Table 4-4 was revised to include the maximum 2nd-high 24-hour PM2.5 and maximum annual PM2.5 concentrations.



Energy Transfer Marketing & Terminals

Air Quality Modeling Report
Ethane Chilling Expansion Project

Marcus Hook, Delaware County, Pennsylvania

February 2023

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1. INTRODUCTION

Energy Transfer Marketing & Terminals L.P. (ETMT), a subsidiary of Energy Transfer L.P., submits this air quality modeling report to support an air quality Plan Approval application that is being submitted to the Pennsylvania Department of Environmental Protection (PADEP or The Department). The application is being submitted to expand the existing permitted ethane chilling capacity at the Marcus Hook Industrial Complex (MHIC). A general map showing the proposed location of the facility is provided in **Attachment A.** This report is a revision to the original modeling report submitted in February 2022 in support of this project. The revisions in this report are in response to comments received from PADEP in August 2022.

1.1 Project Overview

ETMT currently operates three ethane chilling trains at the MHIC with a combined capacity of approximately 75,000 barrels per day (BPD) pipeline feed rate. An approximate 10,000 BPD expansion of this existing ethane chilling capacity is being proposed under this Plan Approval application. In accordance with the adjudication decision by Judge Bernard A. Labuskes, Jr. of the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2016-073-L, this expansion project will be evaluated as part of a single aggregated project with previous natural gas liquids projects at the MHIC. ETMT maintains the assertion that the permitting actions described more fully in the plan approval application for this expansion project do not constitute a single project. ETMT reserves the right to appeal any final action of the Department regarding what constitutes the single aggregated project with respect to this expansion project. This Ethane Chilling Project (Project) involves a specific process design for the planned ethane feedstock. The Project will utilize the available capacity of existing utilities at the site including electricity, steam, the flare header systems, potable water, instrument air, nitrogen, and natural gas.

The Project has the potential to exceed prevention of significant deterioration (PSD) thresholds, as set forth in 40 Code of Federal Regulations (CFR) §52.21 (Prevention of significant deterioration of air quality) due to aggregation. All emissions in this report represent preliminary process designs and associated emission rates as ERM understands them.

1.2 Overview of Methodology

Table 1-1 provides a summary of the attainment status of Delaware County, PA with respect to the National Ambient Air Quality Standards (NAAQS) as specified in 40 CFR §81.339. The attainment status determines which regulatory programs new major sources or modifications to existing sources must address in the context of obtaining an air quality pre-construction permit, or Plan Approval. Table 1-2 provides a summary of the regulatory program(s) that must be addressed for each regulated pollutant that will be emitted by the Project. Pollutants with emission levels that trigger Non-attainment New Source Review (NA-NSR) requirements are subject to additional control (Lowest Achievable Emission Rate, LAER) and emissions offset requirements, but are not required to conduct air quality modeling to assess compliance with the NAAQS. In attainment areas, pollutants that trigger the significant emission rate (SER) must address requirements of the Prevention of Significant Deterioration (PSD) program, which includes air quality modeling.

Table 1-1 Attainment Status of Delaware County, PA

Pollutant	Attainment Status
SO_2 (3-hour, 24-hour, annual)	Attainment

Pollutant	Attainment Status
SO_2 (1-hour)	Unclassifiable/Attainment
CO	Unclassifiable/Attainment
Pb	Unclassifiable/Attainment
PM_{10} (24-hour, Annual)	Unclassifiable
NO_2 (annual)	Unclassifiable
NO_2 (1-hour)	Unclassifiable/Attainment
1997 O_3 (8-hour)	Moderate Nonattainment
2008 O_3 (8-hour)	Marginal Nonattainment
2015 O_3 (8-hour)	Marginal Nonattainment
2012 $PM_{2.5}$ (annual)	Maintenance
1997 & 2006 $PM_{2.5}$ (24-hour)	Maintenance

Applicability of the PSD program for the proposed Project is determined by evaluating whether there is a "significant net emissions increase" of each PSD regulated pollutant. Under PSD, a project is considered major if the project results in a significant emissions increase of any pollutant greater than the SER.

Table 1-2 Applicability of Regulatory Air Programs to the Project

Pollutant	Aggregated Project Emissions (tons/year)	PSD SER (tons/year)	NA-NSR Threshold	PSD Review Required?	NA-NSR Required?
NO_x	63.23	40	N/A	Yes	No
CO	104.00	100	N/A	Yes	No
SO_2	17.92	40	N/A	No	No
PM_{10}	3.95	15	N/A	No	No
$PM_{2.5}$	$PM_{2.5}$: 2.11 NO_X: 63.23 SO_2: 17.92	Direct: 10 NO_X: 40 SO_2: 40	N/A	Yes	No
O_3	NO_X: 63.23 VOC: 183.89	NO_X: 40 VOC: 40	NO_x: 25 VOC: 25	No	Yes
Pb	0.01	0.6	N/A	No	No
H_2SO_4	0.06	7.0	N/A	No	No

Air quality modeling was performed for the pollutants above that are subject to PSD review to assess the ambient air impacts resulting from the emissions of these pollutants due to the Project. The modeling analysis described in this report will conform to Appendix W of 40 CFR Part 51 (Guideline on Air Quality Models). The key elements of the modeling analysis will include:

- Use of the latest version of the regulatory dispersion model and supporting programs at the time of application: AERMOD (version 21112), AERMET (version 21112), AERMINUTE (version 15272), AERMAP (version 18081), AERSURFACE (version 20060), and BPIPRM (version 04274);
- Use of input meteorological data from Philadelphia International Airport (KPHL, WBAN:13739), located approximately 18 km to the northeast of the Project;

- Use of upper air data from Washington Dulles International Airport, VA (WBAN: 93734);
- Use of the ADJ_U* option in AERMET;
- Application of AERSURFACE as recommended in the USEPA AERMOD Implementation Guidance (USEPA 2021a);
- Development of a comprehensive receptor grid designed to identify maximum modeled concentrations;
- Utilization of the Ambient Ratio Method 2 (ARM2) option in AERMOD to characterize NO_2 from modeled concentrations of NO_x;
- In accordance with PSD requirements, determination of whether emissions from the Project that are subject to PSD will have an effect on visibility, growth, soils, and vegetation in the vicinity of the Project;
- Comparison of maximum predicted impacts to relevant Significant Impact Levels (SILs) and Significant Monitoring Concentrations (SMCs) to determine if additional modeling or monitoring could be required; and
- Demonstration via significance modeling that allowable emissions from the proposed facility would not cause or contribute to air pollution exceeding any National Ambient Air Quality Standard (NAAQS) or exceedance of any PSD increment.

It should be noted that ETMT followed recently released EPA draft guidance (USEPA 2021b) related to $PM_{2.5}$ impacts. Although project-related direct emissions of $PM_{2.5}$ do not exceed the PSD significant emission rate for $PM_{2.5}$, the significant emission rate for NO_x is exceeded. NO_x is considered a precursor pollutant for $PM_{2.5}$. The draft EPA guidance suggests that for projects that exceed a significant emission rate for a $PM_{2.5}$ precursor, a complete PSD air quality impact analysis must be conducted that considers both direct emissions of $PM_{2.5}$ and $PM_{2.5}$ precursors. Therefore, ETMT assessed $PM_{2.5}$ as if it were subject to PSD in this air quality modeling analysis.

The modeling analyses indicate that the maximum modeled concentrations (including the contribution from secondary formation for $PM_{2.5}$, as described in Section 3.3.2) do not exceed the SILs for the pollutants under review (NO_2, CO, and $PM_{2.5}$). Maximum modeled concentrations that do not exceed the SILs are not significant and cannot cause or contribute to a modeled exceedance of the NAAQS or PSD increments. Therefore, this report does not address procedures and methodologies that would be needed for cumulative air quality modeling, since these analyses are not required.

1.3 Project Contact Information

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2. PROJECT EMISSIONS AND SOURCE CHARACTERIZATION

2.1 Project Description

This Project will allow for additional processing capacity for liquefied ethane products received through the existing pipelines, which terminate at the MHIC. Currently after exiting the pipeline, ethane is treated to remove carbon dioxide via an amine treating system, and water via a dehydration system. Furthermore, methane impurities are separated from the treated ethane feedstock by a demethanizer and recovered. Treated, dry ethane is chilled before being routed to refrigerated product storage tanks and ultimately transferred offsite. This Project will add to the existing ethane processing capacity at the MHIC by upgrading existing process equipment in key areas including installation of additional chillers and additional compression capacity.

2.2 Modeling Emission Inventory

The air quality impact analyses were conducted for 1-hr and annual NO_2, 1-hr and 8-hour CO, and 24-hr and annual $PM_{2.5}$. The following paragraphs provide a summary of the modeled emissions sources.

As part of the PSD applicability analysis, it must be determined whether the facility has a significant net emissions increase. This is determined by combining emissions from the Project sources with the emissions from existing contemporaneous sources. The following Project-related and contemporaneous sources will be included in the modeling analysis:

- Three (3) Auxiliary Boilers
- West Warm Flare
- ME-1 Cold Flare (Low Pressure)
- ME-1 Cold Flare (High Pressure)
- ME-2 Cold Flare (Low Pressure)
- ME-2x Cold Flare (Low Pressure)
- ME-2x Cold Flare (High Pressure)
- 15-2B Cooling Tower (Mechanical Draft, 6 Cells)
- Two (2) 3-Cell Mechanical Draft Cooling Towers
- Two (2) 5-Cell Wet Surface Air Coolers.

2.2.1 Project Sources

A summary of stack parameters and emission rates for Project sources is shown in **Attachment C** of this report. The sources for all stack parameters and emission rates are also included in **Attachment I** of this report.

It should be noted that the three auxiliary boilers (sources B01, B03, and B04) exhaust through a common bundled tall stack, each with an individual 6.4 ft. diameter flue. Since the individual flues are all co-located in the same bundled stack, ETMT has calculated an effective stack diameter for scenarios where more than one boiler is in operation to account for the combined effect of buoyancy and momentum-induced plume rise from the adjacent plume releases. A total of nine (9) boiler scenarios were included in this analysis, as presented in Table 2-1. The stack parameters and emissions associated with each boiler scenario are presented in **Attachment C**.

Table 2-1 Boiler Scenarios

Scenario Name	Number of Boilers Operating	Boiler Load
1B_50	1	50%
1B_75	1	75%
1B_100	1	100%
2B_50	2	50%
2B_75	2	75%
2B_100	2	100%
3B_50	3	50%
3B_75	3	75%
3B_100	3	100%

2.2.2 Contemporaneous and Aggregated Sources

Contemporaneous sources associated with the project include sources that have had a change in emissions during the previous 5 years. For modeling purposes, the emission rates of these contemporaneous sources will represent the emissions increase or decrease as necessary, and not the potential to emit. Sources included in the modeling assessment due to the Environmental Hearing Board adjudication, not impacted by the Ethane Chilling Expansion Project, are denoted as Aggregated. For modeling purposes, aggregated sources are treated as part of the Project. A summary of these sources and the associated stack parameters and emission rates are also provided in **Attachment C.**

2.3 Building Wake Effects

The USEPA's Building Profile Input Program (BPIP), Version 04274, was used to calculate downwash effects for the modeled emission sources. Building, structure, and tank heights were obtained from measurements taken directly at the facility by ERM and input into BPIP. Downwash influences from existing buildings that are adjacent to the proposed site were considered by analyzing these buildings in BPIP as needed. The emission sources, buildings, and tank heights included in the BPIP analysis are illustrated in **Attachment B.**

3. MODELING METHODOLOGY

3.1 Model Selection and Application

The latest version of USEPA's AERMOD model (version 21112) was used in this air quality analysis with the regulatory default applied (i.e., the DFAULT keyword in the AERMOD control file will be used). As discussed previously, AERMOD will be used to demonstrate that the project will not cause a significant air quality impact. The specific methodologies used for this significance analysis are described below.

3.1.1 Significant Impact Analysis

This section summarizes the model inputs and procedures used to conduct the significant impact analysis for the Project. Specifically, the following analyses are addressed in this section:

- Refined single-source modeling to compare maximum predicted impacts to EPA Significant Impact Levels (SILs); and
- Comparison of refined single-source impacts to EPA Significant Monitoring Concentrations (SMCs)

As discussed in this section, for those pollutant impacts that are demonstrated to be less than applicable SILs, no further analysis will be required because these pollutant impacts will be presumed to not cause or contribute to any modeled violations of a NAAQS or PSD Increment.

For purposes of presentation of all modeling results, it should be noted that all modeled concentrations were not rounded or truncated, in accordance with EPA policy, when compared to the applicable SILs.

3.1.1.1 Significant Impact Analysis Modeling Procedures

The significance analysis involves refined modeling to determine maximum ambient impacts from the Project in comparison to pollutant-specific SILs. The Project and contemporaneous sources that were included in the refined modeling are presented in **Attachment C.** All sources were modeled assuming continuous operation.

The results of the refined modeling were compared to the SILs in order to conservatively estimate the significant impact area for all averaging periods. For 1-hr NO_2, 24-hr $PM_{2.5}$ (NAAQS), and annual $PM_{2.5}$ (NAAQS), the high-1^{st}-high value averaged at each receptor over 5 years is compared to the applicable SILs. For annual NO_2, 24-hr $PM_{2.5}$ (PSD Increment), annual $PM_{2.5}$ (PSD Increment), 1-hr CO, and 8-hr CO, the maximum high-1^{st}-high concentration during the 5 year period is compared to the applicable SILs. The applicable Class II Area SILs used for this analysis are summarized in **Table 3-1**, along with the relevant NAAQS and PSD increments for reference.

Note that the modeling for this Project has shown that the SILs will not be exceeded for any of the pollutants in this model analysis and no cumulative modeling is required. Therefore, this report does not address cumulative air quality analysis procedures.

Table 3-1 Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS [a]	Class II PSD Increment	Class II SIL	SMC
NO_2	1-Hour	188.0 μg/m³ [e]	-	7.5 [i]	-
	Annual	100 μg/m³ [c]	25 [h]	1.0 [k]	14 [m]
CO	1-Hour	40,000 μg/m³ [d]	-	2,000 [k]	
	8-Hour	10,000 μg/m³ [d]	-	500 [k]	575 [m]
PM-2.5	24-Hour	35 μg/m³ [c,f]	9 [d]	1.2 [l]	0 [j]
	Annual	12.0 μg/m³ [g] 15.0 μg/m³ [b,g]	4 [h]	0.2 [l]	-

a) Primary standard unless otherwise noted.
b) Secondary standard.
c) Secondary standard has same value as primary standard.
d) Not to be exceeded more than once per year.
e) 98th percentile of daily maximum 1-hour concentrations for each year, averaged over 3 years.
f) 98th percentile of 24-hour concentrations for each year, averaged over 3 years.
g) Arithmetic mean concentration for each year, averaged over 3 years.
h) Arithmetic mean concentration averaged over a calendar year.
i) Interim SIL recommended by USEPA (memorandum dated June 29, 2010, from Stephen D. Page, "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program") - adopted by PADEP on December 1, 2010.
j) On January 22, 2013, the U.S. Court of Appeals for the District of Columbia Circuit vacated the parts of two PSD rules establishing a PM-2.5 SMC, finding that the EPA was precluded from using the PM-2.5 SMCs to exempt permit applicants from the statutory requirement to compile preconstruction monitoring data.
k) 40 CFR 51.165(b)(2).
l) EPA's April 17, 2018, memorandum, "Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program".
m) 40 CFR § 52.21(i)(5)(i).

3.2 $PM_{2.5}$ Considerations

In January 2013, the SMCs for $PM_{2.5}$ were vacated by the DC Circuit Court. The SMCs are concentrations that are used to determine if a project subject to PSD regulations needs to consider preconstruction ambient monitoring to determine existing air quality conditions at the project site. Therefore, the SMC for $PM_{2.5}$ is listed as 0 μg/m³ in paragraph (i)(5)(i)(c) of 40 CFR 52.21. Preconstruction monitoring is typically required when a project's modeled impacts exceed the SMCs and the existing air quality monitoring network in the region is inadequate to characterize existing air quality. There is an active $PM_{2.5}$ monitoring station located adjacent to the MHIC (Site ID 42-045-0109, Marcus Hook Elementary School) that began taking measurements in 2015. Because it is in close proximity to the site, the air quality measurements at this location are representative of air quality at the Project site. Therefore, preconstruction monitoring should not be required for the Project due to the existence of representative $PM_{2.5}$ ambient air quality data. Section 3.2.1 contains a summary of recent $PM_{2.5}$ data from this monitor.

3.2.1 Representative Background Concentrations of $PM_{2.5}$

Table 3-2 presents the current valid USEPA monitor design values for the Marcus Hook Elementary School $PM_{2.5}$ monitor. As shown in Table 3-2, the most recent monitor values are well below the $PM_{2.5}$ NAAQS. The location of the Marcus Hook Elementary School $PM_{2.5}$ monitor is shown in **Attachment D**.

Table 3-2 $PM_{2.5}$ Monitor Values ($\mu g/m^3$)

Monitor Name	County	Monitor ID	Distance (km) from ETMT Project Site		2019-2021 24-hr Monitor Design Value	2019-2021 Annual Monitor Design Value
Marcus Hook, PA[1]	Delaware County, PA	42-045-0109	0.6	E	22	8.6

[1] – 2019-2021 Data Completeness:
2019: Q1 – 99%, Q2 – 98%, Q3 – 99%, Q4 – 100%
2020: Q1 – 99%, Q2 – 100%, Q3 – 96%, Q4 – 96%
2021: Q1 – 83%, Q2 – 99%, Q3 – 90%, Q4 – 100%

3.2.2 Secondary $PM_{2.5}$ Impacts – Tier 1 Assessment

EPA has provided photochemical modeling results from hypothetical sources due to emissions of $PM_{2.5}$ precursor pollutants NO_x and SO_2 as part of the development of the Modeled Emission Rate of Precursors (MERPs) guidance (USEPA 2019). The use of MERPs for NO_x and SO_2 to determine whether a project would have significant $PM_{2.5}$ impacts (i.e., exceed the applicable SILs) is complicated by the fact that a project's total impact on $PM_{2.5}$ air quality includes contributions from both precursor emissions and direct emissions of $PM_{2.5}$ from project sources. The approach described in the following paragraphs represents a Tier 1 secondary $PM_{2.5}$ assessment, as described in Section 5.4.2(b) in the revised Guideline on Air Quality Models.

In order to assess the total $PM_{2.5}$ impact (primary or secondary), the percentage of the MERPs for the $PM_{2.5}$ precursors was multiplied by the Critical Air Quality Threshold, i.e., the SIL, which was then be added to the design value of the primary $PM_{2.5}$ modeled concentrations determined by AERMOD in the final air quality modeling analysis. This approach is outlined below.

For this analysis, ETMT has considered MERP values derived from the model results for the Chester, PA hypothetical source based on the 500 tpy, 10-m stack height case for NO_x and SO_2 which are more conservative values than the Project emissions and source characteristics. The model results for the Chester, PA hypothetical source were obtained from USEPA's "MERPs View Qlik" internet application[1]. **Table 3-3** presents modeled secondary $PM_{2.5}$ concentrations from the MERPs View Qlik for the 500 tpy NO_x and SO_2 cases, for both the 10-m and 90-m stack height cases. Model results are also available for hypothetical 1000 tpy emissions cases for NO_X and SO_2; however, because the project's emissions of $PM_{2.5}$ precursors are well less than 100 tpy combined, only the lower hypothetical emissions scenarios from the lower 500 tpy cases were considered. As shown in Table 3-3, the maximum modeled results are higher for the 10-m case than the 90-m case (and the resulting MERPs values for the 10-m case are lower as a result), therefore ETMT's selection of the 10-m modeled results to derive project-related $PM_{2.5}$ secondary impacts is a conservative assumption.

Table 3-3 EPA $PM_{2.5}$ Modeling Results – (Chester, PA)

Precursor	Averaging Period	Emissions (tpy)	MERPs (tpy)	Stack Height	Maximum Modeled Values	
					Concentration ($\mu g/m^3$)	Concentration /Emissions ($\mu g/m^3/ton$)
NO_X	24-hour	500	7010	10	8.56E-02	1.71E-04
NO_X	Annual	500	14604	10	6.85E-03	1.37E-05

[1] https://www.epa.gov/scram/merps-view-qlik

Precursor	Averaging Period	Emissions (tpy)	MERPs (tpy)	Stack Height	Maximum Modeled Values	
					Concentration (μg/m³)	Concentration /Emissions (μg/m³/ton)
SO_2	24-hour	500	2263	10	2.65E-01	5.30E-04
SO_2	Annual	500	14724	10	6.79E-03	1.36E-05
NO_X	24-hour	500	11627	90	5.16E-02	1.03E-04
NO_X	Annual	500	43295	90	2.31E-03	4.62E-06
SO_2	24-hour	500	4328	90	1.39E-01	2.78E-04
SO_2	Annual	500	27979	90	3.57E-03	7.14E-06

For 24-hour $PM_{2.5}$, ETMT used the proposed 24-hour $PM_{2.5}$ SIL of 1.2 μg/m³ to represent the critical air quality threshold, while for the annual $PM_{2.5}$ SIL, 0.2 μg/m³ was used. The resulting MERPs values are the following:

24-hour $PM_{2.5}$

NO_x MERP = 1.2 μg/m³ * 500 tpy / 8.56E-02 μg/m³ = 7,010 tpy

SO_2 MERP = 1.2 μg/m³ * 500 tpy / 2.65E-01 μg/m³ = 2,263 tpy

The ETMT project potential emissions of NO_X (63.25 tpy) and SO_2 (17.92 tpy) were then ratioed against the calculated MERP values. The following equation shows the Project's relative percentage of the calculated MERP values, which can then be used to derive a project-related secondary $PM_{2.5}$ impact by applying this percentage to the value of the SIL.

(Project NO_x emissions (63.23 tpy)/NO_X MERP (7,010 tpy) +

(Project SO_2 emissions (17.92 tpy)/SO_2 MERP (2,263 tpy) = 1.7%

Therefore, the amount that was added to the primary $PM_{2.5}$ modeled concentration to account for the contribution of 24-hour secondary $PM_{2.5}$ is (1.2 μg/m³ * 0.017) = **0.02033 μg/m³**. The same procedure was then applied for annual $PM_{2.5}$.

Annual $PM_{2.5}$

NO_x MERP = 0.2 μg/m³ * 500 tpy / 6.85E-03 μg/m³ = 14,604 tpy

SO_2 MERP = 0.2 μg/m³ * 500 tpy / 6.79E-03 μg/m³ = 14,724 tpy

(Project NO_x emissions (63.23 tpy)/NO_X MERP (14,604 tpy) +

(Project SO_2 emissions (17.92 tpy)/SO_2 MERP (14,724 tpy) = 0.6%

Therefore, the amount that was added to the primary annual $PM_{2.5}$ modeled concentration to account for the contribution of annual secondary $PM_{2.5}$ is (0.2 μg/m³ * 0.006) = **0.00111 μg/m³**.

3.3 Geographic Setting

3.3.1 Land Use Characteristics

The Project site is located in an industrial setting in the southeast corner of Delaware County, along the Delaware River. AERMOD was executed in the default rural mode. Land use classifications were reviewed within an area defined by a 3 km radius from the approximate center of the site, and ETMT has determined that the land use within this area is approximately 34% urban classification. This determination was used by analyzing the USGS NLCD 2019 data, where urban classifications were assumed to be category 23 (developed, medium intensity) and category 24 (developed, high intensity). These land use classifications are the closest approximation in the NLCD 2019 data to the land use classifications used by Auer[2] that are specified in Section 7.2.3(a) of Appendix W as being associated with urban classification (Auer land use categories I1 – Heavy industrial, I2 – Light-moderate industrial, C1 – Commercial, R2 – Compact residential, R3 – Compact residential). **Table 3-4** presents the total percentages of each land use category within 10 km of the project site. A graphical representation of this land use analysis is provided in Figure E-1 of **Attachment E**.

Table 3-4 Land Use Classifications within 3-km of the Project

Grid Code	Grid Code Description	Acres	% of Total
11	Open Water	2378.58	34.05
21	Developed, Open Space	616.11	8.82
22	Developed, Low Intensity	771.65	11.05
23	Developed, Medium Intensity	870.15	12.45
24	Developed, High Intensity	1484.60	21.25
	Total Codes 23 and 24:	**2354.75**	**33.70**
31	Barren Land	13.53	0.19
41	Deciduous Forest	430.44	6.16
43	Mixed Forest	7.20	0.10
52	Shrub/Scrub	10.90	0.16
71	Grassland/Herbaceous	40.38	0.58
81	Pasture/Hay	58.72	0.84
82	Cultivated Crops	56.63	0.81
90	Woody Wetlands	106.49	1.52
95	Emergent Herbaceous Wetlands	141.04	2.02
	Total:	**6986.43**	**100.00**

The AERMOD Implementation Guide (USEPA 2021) cautions against the use of the 3-km land use analysis specified in Appendix W as the only consideration for making the urban vs. rural determination for AERMOD applications, particularly in instances where large bodies of water are present within 3-km. The AERMOD implementation guidance suggests that in some cases it may be appropriate to consider possible urban heat island influences across a wider model domain. Therefore, the typical 3-km analysis was expanded to 10-km. At a radius of 10-km, the percentage of NLCD land use categories 23 and 24 drops to 17.5% urban classification. **Table 3-5** presents the total percentages of each land use category within 10 km of the project site. A graphical representation of this expanded land use analysis is provided

[2] Auer, August H. Jr., "Correlation of Land Use and Cover with Meteorological Anomalies", Journal of Applied Meteorology, Volume 17, 1978

in Figure E-2 of **Attachment E**. Since land cover within 10 km appears to be mostly rural classification, the urban option in AERMOD is not used.

Table 3-5 Land Use Classifications within 10-km of the Project

Grid Code	Grid Code Description	Acres	% of Total
11	Open Water	10,752.32	13.86
21	Developed, Open Space	13,105.13	16.89
22	Developed, Low Intensity	13,871.48	17.88
23	Developed, Medium Intensity	8,280.83	10.67
24	Developed, High Intensity	5,263.12	6.78
	Total Codes 23 and 24:	13,543.95	17.45
31	Barren Land	144.92	0.19
41	Deciduous Forest	7,404.78	9.54
43	Mixed Forest	457.65	0.59
52	Shrub/Scrub	201.58	0.26
71	Grassland/Herbaceous	695.93	0.90
81	Pasture/Hay	1,066.20	1.37
82	Cultivated Crops	4,782.02	6.16
90	Woody Wetlands	6,025.11	7.76
95	Emergent Herbaceous Wetlands	5,549.63	7.15
	Total:	**77,600.69**	**100**

3.3.2 Terrain

The Project site is located on relatively flat terrain along the Delaware River. The elevation of the industrial complex surrounding the Project site is approximately 17 ft, and no significant topographical features exist near the Project site. The latest version of USEPA's AERMAP program (version 18081) was used to determine the ground elevation and hill scale for each receptor, based on data obtained from the USGS National Elevation Database (NED). The most recent NED data available at 1/3 arc-second horizontal resolution, or 10 m, was used in AERMAP.

3.3.3 Effects on Growth, Soils, Vegetation, and Visibility

PSD requirements include an evaluation of the effects of growth due to a project, and an evaluation of the effects of project emissions on soils, vegetation, and visibility. Evaluation of potential impact on vegetation and soils was performed by comparison of maximum modeled impacts from the Project to AQRV screening concentrations provided in the EPA document "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals" (USEPA 1980) and to NAAQS secondary standards. The screening levels represent the minimum concentrations in either plant tissue or soils at which adverse growth effects or tissue injury was reported in the literature. The NAAQS secondary standards were set to protect public welfare, including protection against damage to crops and vegetation. Therefore, comparing the modeled emissions to the AQRVs and the NAAQS secondary standards provides an indication as to whether potential impacts are likely to be significant. **Table 3-6** summarizes the applicable AQRVs or NAAQS secondary standards.

Table 3-6 Summary of Applicable AQRVs and AAQs

Compound	Averaging Period	AQRV Screening Levels (μg/m^3)	Secondary NAAQS (μg/m^3)
$PM_{2.5}$	24-hour	--	35
	Annual	--	15
NO_2	4-hour	3,760	--
	8-hour	3,760	--
	1-month[1]	564	--
	Annual	100	100
CO	1-hour	--	--
	8-hour	--	--
	Weekly[1]	1,800,000	--

"--" = not applicable or not available.
[1] 1-Month and Weekly average impact approximated by modeled 24-hour average impact.

In addition to the analysis of criteria pollutants above, ETMT also considered the effects of emissions of project related non-criteria pollutants (specifically HAP metals from the auxiliary boilers) on soils and vegetation. Specifically, Table 5.7 of Section 5.2.2 of EPA 1980 was used to refer to tabulated significant emissions rates of various trace elements. Emissions of these trace elements will be less than the significant emission rates tabulated in the EPA 1980 guidance. **Table 3-7** presents these emissions and the relevant comparisons to the significant emission rates, taking into consideration adjustments based on a conservative estimate of plant lifetime, as well as stack characteristics (equation 5.9 and Table 5.8 in EPA 1980, respectively).

Table 3-7 Emissions of Trace Elements and Comparison to Significant Emission Rates

Compound	Project Emissions (tons/yr)	Significant Emission Rates (Tons/Yr)[1]	
		Soils	Plant Tissue
Arsenic	0.0010	0.137	0.082
Cadmium	0.0056	0.113	0.013
Chromium	0.0071	0.377	2.298
Cobalt	0.0004	--	7.889
Copper	0.0043	1.818	0.072
Lead	0.0100	44.590	12.691
Manganese	0.0019	0.113	277.830
Mercury	0.0013	20.923	--
Nickel	0.0106	22.981	58.310

Compound	Project Emissions (tons/yr)	Significant Emission Rates (Tons/Yr)[1]	
		Soils	Plant Tissue
Selenium	0.0001	0.583	4.459
Vanadium	0.0116	0.113	--
Zinc	0.1466	--	21.609

[1] - Significant Emission Rates calculated from values published in Table 5.7 of EPA 1980, adjusted to a 100-year facility lifetime, and adjusted to a 30 m stack with 350K exhaust temperature and 4 m^3/sec flowrate. These stack characteristics are the most similar in Table 5.8 of EPA 1980 compared to the Auxiliary Boiler stack characteristics.

With respect to visibility impacts, it should be noted that the facility will comply with the applicable PADEP visible emissions regulations. In addition, ETMT assessed the Project's visibility impact on the John Heinz National Wildlife Refuge at Tinicum, using the USEPA VISCREEN (Version 1.01, dated 13190) visibility model. VISCREEN was executed following the procedures described in EPA's Workbook for Plume Visual Impact Screening and Analysis for Level-1 visibility assessments (USEPA 1992), along with the following input settings:

- Source-Observer distance: 11.5 km
- Minimum Source-Area distance: 11.5 km
- Maximum Source-Area distance: 17 km
- Background Visual Range: 40 km

The VISCREEN analysis described above was originally developed for use in Class I areas. Class I areas are pristine natural areas afforded special environmental protection under federal regulations. By applying VISCREEN to this nearby area, ETMT is taking a conservative approach to assessing the Project's impacts on visibility. Although the John Heinz National Wildlife Refuge is not a Class I area, ETMT believes that it could be reasonably afforded special consideration for visibility impacts within the context of the additional impact analyses required under the PSD rules. The refuge's website for visitors[3] describes attractions within the area that are specifically focused on the enjoyment of scenic views and wildlife observation. According to the website, the refuge offers a vista of the Philadelphia skyline contrasted with the Tinicum Tidal Marsh, as well as observation towers for viewing wildlife. Therefore, ETMT believes this analysis in the John Heinz National Wildlife Refuge is appropriate and satisfies the requirements of PSD to evaluate visibility impacts.

With respect to the Project's impact on regional growth, it is important to note that the Project site is located in an area that has operated as an industrialized area for more than 100 years. The existing commercial, residential, industrial, and other infrastructure are capable of handling this Project that will itself be constructed and operated by local workers within an existing industrial complex. The construction of new housing, restaurants, roads, public transportation or similar improvements will not be required as a result of this Project. Feedstock for this Project will be shipped via pipeline, and it is not anticipated that suppliers of raw material will co-locate near the industrial complex where the Project is located. Additional air quality impacts due to commercial, residential, industrial, or other growth in the area are not anticipated in association with this Project.

3.4 Receptor Grids

For this modeling analysis, the following receptor grid was developed:

[3] Plan Your Visit - John Heinz at Tinicum - U.S. Fish and Wildlife Service (fws.gov)

- 25-meter spacing along the fence line;
- 50-meter spacing from the fence line to 1.5 km from the facility;
- 100-meter spacing from 1.5 km to 2 km from the facility;
- 200-meter spacing from 2 km to 3 km from the facility;
- 300-meter spacing from 3 km to 5 km from the facility;
- 500-meter spacing from 5 km to 10 km from the facility; and
- 1-km spacing from 10 km to 25 km from the facility.

As noted previously, AERMAP was used to define ground elevations and hill scales for each receptor. ETMT analyzed isopleths of modeled concentrations due to the proposed Project and determined that the receptor grid adequately accounts for the worst-case modeled concentrations.

The facility fence line was used as the boundary to determine ambient air. No receptors were placed within the fence line boundary with the exception of the discrete receptors added along the public roadway that divides portions of the property. The public is restricted from access to ETMT property through the following security measures:

- All land boundaries at the Facility and outlying tank farms are surrounded by a minimum six-foot high chain link fence topped with barbed wire.
- Entrance and exit gates are locked and/or guarded.
- Security Department surveillance systems, which include mobile guard units exercising 24-hour surveillance of the perimeter, entrances, and exits, protect the Facility from unauthorized intrusions.

ETMT refined the maximum modeled impacts identified with the receptor grid above to a resolution of 50-m, for any maximum modeled concentration in the significance analysis that occurs outside of the 50-m spaced receptors. No further refinement was needed beyond 50-m resolution, as none of the maximum modeled concentrations exceed 90% of the SIL value.

3.5 Meteorological Data for Air Quality Modeling

ETMT utilized meteorological data collected from 2016-2020 at the Philadelphia International Airport (KPHL) in the air quality modeling analysis. The KPHL Automated Surface Observation System (ASOS) system is located on the eastern side of the airport property, approximately 18 km to the northeast of the proposed Project site. Upper air data from Washington Dulles International Airport in Sterling, VA will also be used in the analysis. ETMT will use processed meteorological data provided by PADEP for the above-mentioned surface and upper air stations. The following is a summary of PADEP's AERMET processing methodology:

- AERMET version 21112 was used to process the surface and upper air meteorological data;
- The friction velocity adjustment method (ADJ_U* option) was used;
- One-minute and five-minute ASOS data were processed for input into AERMET through the use of the AERMINUTE version 15272 preprocessor;
- AERSURFACE was run 6 times - average, wet, dry moisture conditions with snow/no snow for winter for each moisture condition;
- For each month in the period 2016-2020, the climatological norms (calculated by data from NOAA's National Centers for Environmental Information (NCEI)) for the Pennsylvania Climate division No. 3 and KPHL were used to determine the correct settings for AERMET;

- The resulting files were processed into five (5) individual calendar years.

AERMET processing is performed in three (3) stages. Stage 1 processing reads the raw onsite, surface, and upper air files, performs data range and completeness checks, and prepares files for input to Stage 2. Stage 2 reads the files prepared in Stage 1 and prepares a single merged file with all necessary inputs for Stage 3. Stage 3 carries out the boundary layer parameterizations needed to calculate surface parameters such as the friction velocity, convective velocity scale, Monin-Obukhov length scale, and convective and mechanical mixing depths.

The meteorological data completeness of the five-year AERMET surface file is provided in **Attachment F**. All calendar quarters for the 2016-2020 period met the EPA 90% data completeness criteria.

3.5.1 Friction Velocity (u*) Adjustment Method

The friction velocity adjustment method (ADJ_U* option) adjusts the friction velocity calculated by AERMET under stable, low wind speed conditions to address known model overprediction issues under those conditions that are directly associated with underprediction of u* by AERMET when this option is not used.

The ADJ_U* option addresses a known bias towards underprediction of friction velocity under stable, low wind speed conditions, leading to observed model overprediction for these conditions. The maximum modeled 1-hr concentrations all occur during period of low wind (less than 1 m/s) between the hours of midnight to 0400; therefore, it is appropriate to utilize the ADJ_U* option in this analysis as low wind speed conditions cause the highest hourly modeled concentrations.

The ADJ_U* option has been subject to extensive model evaluation, showing superior performance compared to the default AERMET. Subsequently, ADJ_U* is now included as a regulatory default option in AERMET.

3.5.2 Summary of AERMET Location Inputs

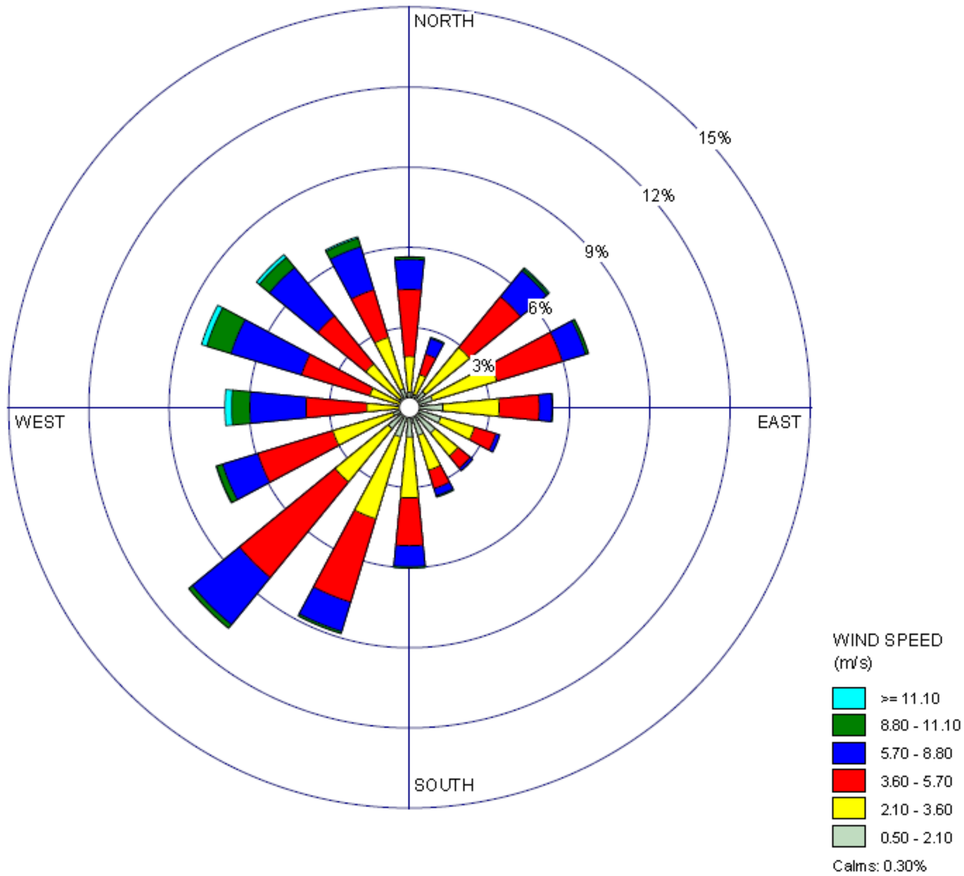
Integrated Surface Hourly Data (ISHD) format data from KPHL were input in the AERMET “SURFACE” pathway and FSL format upper air data were input in the AERMET “UPPERAIR” pathway. The following location data were used in AERMET:

- KPHL ASOS Location: 39.873N, 75.227W - verified with aerial imagery;
- KPHL ASOS Elevation: 2.02 m –verified with USGS NED data;
- Sterling, VA Upper Air Location: 38.98N, 77.47W – noted in FSL file header.

3.5.3 Meteorological Data Representativeness

The KPHL ASOS station is located approximately 18 km to the northeast of the Project site. Surface meteorological measurements at KPHL are representative of the Project site because of the close proximity and similar location of both sites along the Delaware River in an industrial setting. The Project site and KPHL are located within a close enough distance such that they are affected by the same local weather conditions. The terrain in the vicinity of both sites is mostly flat, with no significant terrain features affecting either location that would influence local winds or weather conditions. The location of the Project site and the KPHL ASOS station is presented in **Attachment G**, overlaid on a USGS topographical map. A wind rose showing the wind pattern observed at KPHL for 2016-2020 is shown in **Figure 3-1**.

Figure 3-1 KPHL Wind Rose – 2016-2020



3.5.3.1 Representativeness of Surface Characteristics

The surface characteristics required by AERMET (surface roughness, Bowen ratio, and albedo) are required to be representative of the meteorological measurement site, as specified in the EPA's AERMOD Implementation Guidance. PADEP used the AERSURFACE (Version 20060) land use processor to develop the necessary micrometeorological parameters for use in AERMET. The following is a summary of the settings that were used in AERSURFACE provided by PADEP:

- USGS 2016 NLCD input land use data
- Center Latitude (decimal degrees): 39.873
- Center Longitude (decimal degrees): -75.227
- Datum: NAD83
- Study radius (km) for surface roughness: 1.0
- Airport? Y, Continuous snow cover? **Variable**
- Surface moisture? **Variable**, Arid region? N

- Month/Season assignments? Default
- Late autumn after frost and harvest, or winter with no snow: **12 1 2**
- Winter with continuous snow on the ground: **12 1 2**
- Transitional spring (partial green coverage, short annuals): 3 4 5
- Midsummer with lush vegetation: 6 7 8
- Autumn with unharvested cropland: 9 10 11

The variable inputs will be based on climatological data compiled by NOAA-NWS and NCEI. The moisture characterization and snow cover were characterized on a month-to-month basis based on NCEI estimates of surface moisture conditions for the Pennsylvania Climate Division 3 and also based on snow observation records for the Philadelphia International Airport station. AERSURFACE was executed with a monthly resolution with 7 wind direction sectors.

As noted previously, the KPHL ASOS station is located approximately 18 km to the northeast of the Project site. Bowen ratio and albedo are bulk variables in AERMET, that is, they are intended to be representative of the greater modeling domain as opposed to being highly site specific. AERSURFACE determines the appropriate value of Bowen ratio and albedo by considering the land use within a 10 km by 10 km area centered on the meteorological measurement site. Surface roughness is an important variable required by AERMET. One of the critical uses of surface roughness is in the internal profiling scheme used by AERMOD for wind speed and turbulence parameters. The AERMOD implementation guidance suggests that surface roughness be based on the land use type within 1 km of the meteorological measurement site.

The NLCD 2016 land use data analyzed by AERSURFACE produce very similar average albedo and Bowen ratio values between the proposed Project and the airport site. The surface roughness values between the two sites are also in good agreement from the 60° (ENE) to 260° (WSW) wind direction sectors. Modeling results indicate that the maximum modeled concentrations occur at receptors that are downwind of the facility for these wind directions. Therefore, ETMT concludes that the land use characteristics at KPHL are representative of the micrometeorological factors that would affect plume dispersion at the Project site. Figures presenting the micrometeorological variable comparisons sectors between KPHL and the Project site are provided in **Attachment H**. Although the maximum modeled concentrations occur in wind directions with similar surface roughness values between the two sites, ETMT has provided a separate set of analyses to serve as a comparison to the maximum modeled concentrations presented in Section 4. These separate analyses used KPHL meteorological data processed with site-derived surface characteristics assuming no snow cover and average moisture and are included in the electronic modeling archive submitted with this report.

3.5.4 Upper Air Data

AERMET uses upper air data to determine an initial potential temperature distribution from the morning sounding. For the United States, the morning sounding is assumed to be roughly equivalent to the 12Z sounding. The initial potential temperature gradient is used by AERMET to establish the convective mixing heights calculated for each daytime hour of the day. Because the upper air data is only used for one observation per day, and that observation is, in turn, used to establish how the convective boundary layer will grow in height as the day progresses, it is important to choose an upper air station that is generally representative of the atmosphere for the area of interest, taking into consideration the availability of upper air data in the region. Three upper air stations are located within approximately 300 km of the proposed Project:

- Sterling, VA – 200 km to the southwest

- Wallops Island, VA – 208 km to the south
- Brookhaven, NY – 245 km to the northeast

Sterling is the closest upper air station to the Project and is considered regionally representative of southeastern Pennsylvania. Wallops Island and Brookhaven are not only further away but are also located in coastal areas that have a strong influence from the Atlantic Ocean. The ocean has regional influence on atmospheric stability and is not considered representative of the Project site. ETMT will use Sterling upper air data with a "search window" of -3 to +1 to capture as many representative soundings as possible. Availability of upper air soundings from Sterling were reviewed to determine whether it is necessary to substitute soundings from a secondary sounding station. A review of sounding availability indicates that no substitutions will be necessary. In addition, the MODIFY keyword was used in the Upper Air pathway in AERMET. This keyword effectively reduces the number of levels extracted in AERMET by deleting mandatory sounding levels that are within 1% of a significant level (based on pressure), sets calm wind directions to 0 (although wind data from the sounding are not utilized by AERMET, nor are they passed through AERMET for use in AERMOD), and interpolates missing ambient and dew point temperatures if sufficient data below and above the missing level are available.

3.6 Class I Impacts

Under the PSD program, Class I areas are assigned to protect Federal wilderness areas such as national parks and wildlife refuges, where the least amount of air quality deterioration is allowed. Class I areas are designated as pristine natural areas or areas of natural significance. The closest identified Class I area is the Brigantine National Wildlife Refuge in New Jersey, approximately 90 km east-southeast from the Project site. The distances to other Class I areas identified in the region are presented in **Table 3-8**, along with the Q/D ratio for each Class I area. The Q/D ratio is the ratio of total project-related emissions of NO_x, SO_2, PM_{10}, and H_2SO_4 (expressed in tpy) over the distance to the Class I area (expressed in km). According to National Park Service (NPS) guidance (NPS 2010), projects with a Q/D ratio less than 10 would not be required to conduct an analysis of Air Quality Related Values (AQRVs) in the Class I area under consideration.

Table 3-8 Distances to Class I Areas and Q/D Values

Class I Area	Approximate Distance from Project (km)	Q/D[1]
Brigantine National Wildlife Refuge, NJ	90	0.946
Shenandoah National Park, VA	260	0.328
Dolly Sods Wilderness, WV	335	0.254
Otter Creek Wilderness, WV	360	0.237

[1] – Project-related emissions increase, based on short-term emission rates expressed in TPY for each pollutant:
NO_X: 63.23
SO_2: 17.92
PM_{10}: 3.95
H_2SO_4: 0.06
Total Q = 85.16

Secondary $PM_{2.5}$ Impacts –Since the Q/D ratios for all Class I areas listed above are under 10, ETMT proposes to not conduct an analysis of AQRVs in any Class I area. ETMT will notify Federal Land Managers (FLM's) of the proposed project and will provide them with the Q/D analysis in order to confirm that no AQRV analysis is necessary.

ETMT evaluated the project related increase of NO_X and $PM_{2.5}$ against the Class I SILs by applying the AERMOD dispersion model to receptors specified by NPS[4] for each Class I area listed in Table 3-7. PADEP has processed these NPS receptors by first converting them from Latitude/Longitude coordinates to UTM Zone 18 coordinates, and then applying AERMAP to determine the appropriate elevations and hill scales per receptor. Recent EPA guidance (USEPA 2016) for long range transport suggests that, ""[d]ue to variations in meteorology that are expected to occur beyond 50 km and the time required for a plume to travel this distance, steady-state plume models like AERMOD are expected to be conservative in the far-field." Therefore, ETMT believes that this approach is conservative and appropriate to evaluate the project against the Class I SILs in each Class I area. **Table 3-9** presents the Class I SILs. It should also be noted that ETMT has conservatively applied the project-related $PM_{2.5}$ concentration from secondary formation calculated in Section 3.2.2 to the modeled $PM_{2.5}$ concentrations at the Class I receptors.

Table 3-9 Class I SILs

Pollutant	Annual SIL ($\mu g/m^3$)	24-hour SIL ($\mu g/m^3$)	3-hour SIL ($\mu g/m^3$)
NO_2[1]	0.1	-	-
$PM_{2.5}$[2]	0.05	0.27	

[1] Proposed USEPA SILs for Class I Areas published in the Federal Register (61 FR 38249) Prevention of Significant Deterioration and Nonattainment New Source Review, Proposed Rule. July 23, 1996.
[2] Class I $PM_{2.5}$ SILs as specified in EPA Guidance on SILs for ozone and fine particles (USEPA 2018)

[4] Class I receptors available at https://irma.nps.gov/DataStore/Reference/Profile/2249830

4. MODEL RESULTS PRESENTATION

The results of the air quality modeling analyses are summarized in the following sections. It should be noted that additional model results have been provided to PADEP that used meteorological data processed with site surface characteristics, for comparison purposes as discussed in Section 3.5.3.1. The results of these additional analyses, available in the electronic modeling archive, do not change any of the conclusions of the analyses presented in the following sections.

The Class II SIL analysis considered all of the boiler scenarios described in Section 2.2.1. For the Class II $PM_{2.5}$ PSD Increment Analysis, the Class I SIL Analysis, and the Soils and Vegetation Effects analyses, the boiler stack parameters and emission rates that were used in the analysis were chosen based on the scenario that resulted in the maximum total concentration in the Class II SIL analysis for each pollutant and averaging period combination.

4.1 Class II SIL Analysis Results

The maximum modeled concentrations for the Project relative to the relevant SILs are presented in Tables 4-1 through 4-3 below. As indicated in the tables, the Project has modeled concentrations for 1-hr and annual NO_2, 1-hr and 8-hr CO, and 24-hr and annual $PM_{2.5}$ that are below the applicable SILs. The applicable SMC's, as described below, were not exceeded for any averaging period for any compound. ETMT therefore asserts that additional monitoring is not necessary.

Table 4-1 NO_2 SIL Analysis Results – Maximum Modeled Concentrations

Pollutant	Averaging Period	Modeled Scenario	Maximum Modeled Concentration	Secondary $PM_{2.5}$	Total Concentration	Significant Impact Level (SIL)	Significant Monitoring Concentration (SMC)
			µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
NO_2	1-hr	1b_50	4.319	--	4.319	7.5	--
	Annual		0.149	--	0.149	1	14
	1-hr	1b_75	4.319	--	4.319	7.5	--
	Annual		0.155	--	0.155	1	14
	1-hr	1b_100	4.319	--	4.319	7.5	--
	Annual		0.161	--	0.161	1	14
	1-hr	2b_50	4.319	--	4.319	7.5	--
	Annual		0.161	--	0.161	1	14
	1-hr	2b_75	4.319	--	4.319	7.5	--
	Annual		0.169	--	0.169	1	14
	1-hr	2b_100	4.320	--	4.320	7.5	--
	Annual		0.176	--	0.176	1	14
	1-hr	3b_50	4.319	--	4.319	7.5	--
	Annual		0.169	--	0.169	1	14
	1-hr	3b_75	4.320	--	4.320	7.5	--
	Annual		0.178	--	0.178	1	14
	1-hr	3b_100	4.320	--	4.320	7.5	--
	Annual[1]		0.184	--	0.184	1	14

[1] - Scenario used in Class I SIL and the soils and vegetation effects analyses.

Table 4-2 $PM_{2.5}$ SIL Analysis Results – Maximum Modeled Concentrations

Pollutant	Averaging Period	Modeled Scenario	Maximum Modeled Concentration Averaged Over 5 Years[2]	Secondary $PM_{2.5}$	Total Concentration[2]	Maximum Modeled Concentration in 5-Year Period[3]	Total Concentration[3]	Significant Impact Level (SIL)
			µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
$PM_{2.5}$	24-hr[1]	1b_50	0.135	0.0203	0.155	0.169	0.189	1.2
	Annual		0.016	0.0011	0.017	0.017	0.018	0.2
	24-hr	1b_75	0.135	0.0203	0.155	0.178	0.198	1.2
	Annual		0.016	0.0011	0.017	0.017	0.019	0.2
	24-hr	1b_100	0.135	0.0203	0.155	0.186	0.206	1.2
	Annual		0.016	0.0011	0.017	0.018	0.019	0.2
	24-hr	2b_50	0.135	0.0203	0.155	0.189	0.209	1.2
	Annual		0.016	0.0011	0.017	0.018	0.019	0.2
	24-hr	2b_75	0.137	0.0203	0.157	0.198	0.219	1.2
	Annual		0.016	0.0011	0.018	0.018	0.020	0.2
	24-hr	2b_100	0.139	0.0203	0.159	0.206	0.226	1.2
	Annual		0.017	0.0011	0.018	0.019	0.020	0.2
	24-hr	3b_50	0.137	0.0203	0.157	0.202	0.222	1.2
	Annual		0.016	0.0011	0.017	0.018	0.019	0.2
	24-hr	3b_75	0.140	0.0203	0.161	0.209	0.229	1.2
	Annual		0.017	0.0011	0.018	0.019	0.020	0.2
	24-hr	3b_100	0.145	0.0203	0.166	0.215	0.235	1.2
	Annual[1]		0.017	0.0011	0.018	0.020	0.021	0.2

[1] - Scenario used in Class II $PM_{2.5}$ PSD increment, Class I SIL, and the soils and vegetation effects analyses.
[2] - Maximum modeled concentrations averaged over 5 years.
[3] - Maximum modeled concentration in the 5-year period (H1H concentration determined by running each year separately).

Table 4-3 CO SIL Analysis Results – Maximum Modeled Concentrations

Pollutant	Averaging Period	Modeled Scenario	Maximum Modeled Concentration	Secondary $PM_{2.5}$	Total Concentration	Significant Impact Level (SIL)	Significant Monitoring Concentration (SMC)
			µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
CO	1-hr	1b_50	25.688	--	25.688	2000	--
	8-hr		8.466	--	8.466	500	575
	1-hr	1b_75	25.688	--	25.688	2000	--
	8-hr		8.572	--	8.572	500	575
	1-hr	1b_100	25.689	--	25.689	2000	--
	8-hr		8.686	--	8.686	500	575
	1-hr	2b_50	25.689	--	25.689	2000	--
	8-hr		8.719	--	8.719	500	575
	1-hr	2b_75	25.689	--	25.689	2000	--
	8-hr		8.897	--	8.897	500	575
	1-hr	2b_100	25.690	--	25.690	2000	--
	8-hr		9.019	--	9.019	500	575
	1-hr	3b_50	25.689	--	25.689	2000	--
	8-hr		8.932	--	8.932	500	575
	1-hr	3b_75	25.690	--	25.690	2000	--
	8-hr		9.101	--	9.101	500	575
	1-hr[1]	3b_100	25.691	--	25.691	2000	--
	8-hr		9.196	--	9.196	500	575

[1] - Scenario used in the soils and vegetation effects analyses.

4.2 Class II PM2.5 Increment Analysis Results

Although the Class II SILs are not exceeded, ETMT has conservatively presented the PM2.5 modeled impacts in the form of the PM2.5 increment (highest-second highest 24-hr modeled concentration per year, and maximum annual modeled concentration) for comparison to the Class II PM2.5 increment. These modeled concentrations are presented in Table 4-4 below along with the values of the Class II PM2.5 increment.

Table 4-4 $PM_{2.5}$ PSD Increment Modeling Results

Pollutant	Averaging Period	Modeled Scenario	Maximum Modeled Concentration	Secondary $PM_{2.5}$	Total Concentration	PSD Increment
			µg/m³	µg/m³	µg/m³	µg/m³
$PM_{2.5}$	24-hr[1]	3b_100	0.152	0.0203	0.173	9
	Annual[2]	3b_100	0.020	0.0011	0.021	4

[1] 24-hr $PM_{2.5}$ represent the highest second highest concentrations over the 5-year period.
[2] Annual $PM_{2.5}$ modeled concentrations represent the maximum values over a 5-year period.

4.3 Class I SIL Analysis Results

Table 4-5 presents the results of the Class I modeling analysis for annual NO_2 and 24-hr and annual $PM_{2.5}$. Each Class I area was analyzed using the receptors described in Section 3.6 and provided by

PADEP. The results of this analysis show that the maximum modeled concentrations are less than the Class I SILs for these receptors.

Table 4-5 Maximum Modeled Concentrations – Class I Analysis

Class I Area	Pollutant	Averaging Period	Maximum Modeled Concentration	Secondary $PM_{2.5}$	Total Concentration	Class I SIL
			µg/m³	µg/m³	µg/m³	µg/m³
Brigantine National Wildlife Refuge, NJ	NO_2	Annual	0.0015	--	0.0015	0.10
	$PM_{2.5}$	24-hr	0.0007	0.0203	0.0210	0.27
		Annual	0.0001	0.0011	0.0012	0.05
Shenandoah National Park, VA	NO_2	Annual	0.0006	--	0.0002	0.10
	$PM_{2.5}$	24-hr	0.0003	0.0203	0.0204	0.27
		Annual	0.0001	0.0011	0.0011	0.05
Dolly Sods Wilderness, WV	NO_2	Annual	0.0002	--	0.0002	0.10
	$PM_{2.5}$	24-hr	0.0001	0.0203	0.0204	0.27
		Annual	0.0000	0.0011	0.0011	0.05
Otter Creek Wilderness, WV	NO_2	Annual	0.0002	--	0.0002	0.10
	$PM_{2.5}$	24-hr	0.0001	0.0203	0.0204	0.27
		Annual	0.0000	0.0011	0.0011	0.05

4.4 Effects on Soils, Vegetation, and Visibility

Table 4-6 presents the results of the air quality modeling analyses for NO_X, CO, and $PM_{2.5}$ compared to the thresholds that are relevant to adverse impacts on soils and vegetation described in Section 3.3.3. The results of this analysis show that the Project emissions would not be expected to have an adverse impact.

Table 4-6 Maximum Modeled Concentrations – Soils and Vegetation

Pollutant	Averaging Period	AQRV Screening Level	Secondary NAAQS	Maximum Modeled Concentration	Secondary $PM_{2.5}$	Total Concentration
		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
NO_2	4-hr	3760	--	2.663	--	2.663
	8-hr	3760	--	2.495	--	2.495
	1-month[1]	564	--	1.333	--	1.333
	Annual	100	100	0.184	--	0.184
CO	Weekly[1]	1800000	--	5.309	--	5.309
$PM_{2.5}$	24-hr	--	35	0.163	0.020	0.184
	Annual	--	15	0.020	0.001	0.021

Table 4-7 presents the results of the VISCREEN Level 1 analysis for John Heinz National Wildlife Refuge at Tinicum. The plume perceptibility and contrast calculated by VISCREEN are less than the Class I plume visibility screening criteria.

Table 4-7 VISCREEN Level I Analysis

Background	Theta[a]	Azimuth[b]	Distance	Alpha[c]	Perceptibility (ΔE)[d]		Contrast (C)[e]	
	degrees	*degrees*	*km*	*degrees*	*Criteria*	*Plume*	*Criteria*	*Plume*
Sky	10	147	17	21	2	0.745	0.05	-0.002
Sky	140	147	17	21	2	0.275	0.05	-0.003
Terrain	10	84	11.5	84	2	0.206	0.05	0.001
Terrain	140	84	11.5	84	2	0.063	0.05	0.001

a - Theta is the vertical angle subtended by the plume
b - Azimuth is the angle between the line connecting the source, observer and the line of sight
c - Alpha is the angle between the line of sight and the plume centerline
d - Plume perceptibility parameter (dimensionless)
e - Visual contrast against background parameter (dimensionless)

4.5 Conclusions

The air quality modeling analyses presented in this report have demonstrated that the Project will result in insignificant modeled concentrations in Class II and Class I areas and has also demonstrated no adverse impact with respect to soils, vegetation, and visibility.

An electronic data submittal is being provided to PADEP via online file sharing concurrently with this revised report. The following summarizes the contents of the electronic data submittal:

- AERMOD input and output files for the Class II and Class I SILs, and soils and vegetation analyses
- VISCREEN input and output files
- AERMOD input and output files for the PHL and Site micrometeorological surface characteristics sensitivity demonstration
- AERMAP input and output
- AERMET input and output, including all raw meteorological data
  - AERSURFACE input and output, including data sources used to derive moisture assumptions
  - Surface roughness calculation spreadsheet
- BPIP input and output

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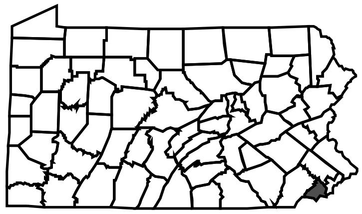
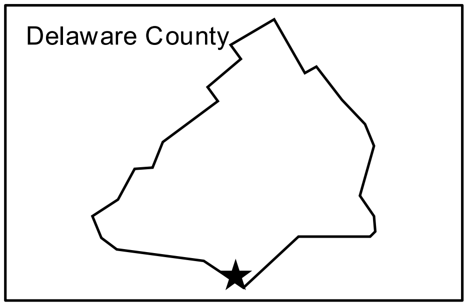
U.S. Environmental Protection Agency. (USEPA 2021b) USEPA guidance "Revised DRAFT Guidance for Ozone and Fine Particulate Matter Permit Modeling", USEPA Office of Air Quality Planning and Standards, Raleigh, NC. EPA-454/P-21-001, September 2021.

U.S. Environmental Protection Agency. (USEPA 2021c) AERSCREEN User's Guide, EPA-454/B-21-005, April 2021.

ATTACHMENT A FACILITY LOCATION





0 1,000 2,000 4,000
Feet

N

LAT. 39.810878 LON. -75.429566647
DELAWARE COUNTY
PENNSYLVANIA

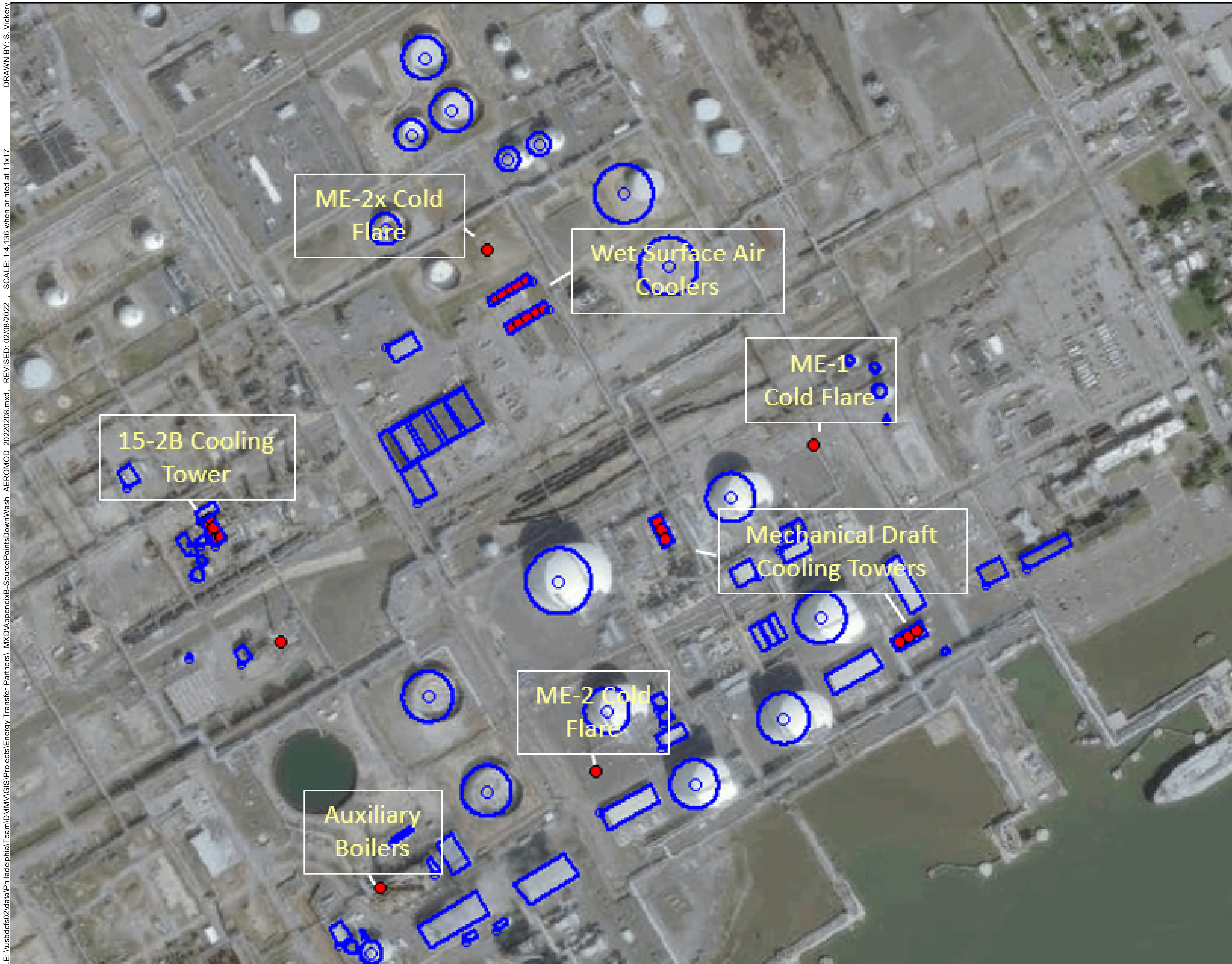
USGS 1:24K 7.5' Quadrangle:
Marcus Hook, PA

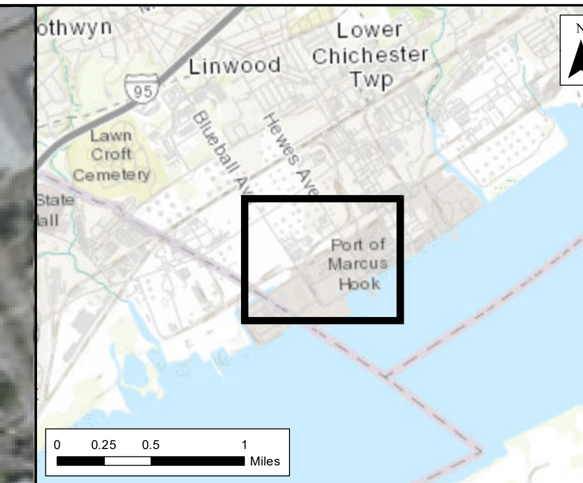
SITE LOCATION MAP

ERM	**Sunoco Partners Marketing & Terminals, L.P. (SPMT)** Sunoco Partners Marketing & Terminals, L.P. (SPMT) Delaware County, Pennsylvania	GIS Review: JR CHK'D: JR 0364735
Drawn By: SRV-12/7/21	**Environmental Resources Management**	ATTACHMENT A

J:\Projects\Sunoco Logistics_MXD\Figure1-SiteLocationMap.mxd - 12/8/2021|SRV

ATTACHMENT B FACILITY LAYOUT





Legend

- Point Sources
- Downwash Structures

Notes:

N

0 380 760
Feet

Appendix B
Source Point and Downwash Area Modeling
Marcus Hook
Energy Transfer Partners L.P.
Marcus Hook, Pennsylvania

Environmental Resources Management
www.erm.com
ERM

Source: Esri - World Topographic Map; NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

FILE: \\usbdcfs02\data\Philadelphia\Team\DMM\GIS\Projects\Energy Transfer Partners_MXD\AppendixB-SourcePointsDownWash_AEROMOD_20220208.mxd REVISED: 02/08/2022 SCALE: 1:4,136 when printed at 11x17 DRAWN BY: S. Vickery

ATTACHMENT C MODEL SOURCE INFORMATION

Source	Title V Source ID	Source Type	Boiler Scenario	UTME	UTMN	Elevation	Stack Height	Stack Diameter	Stack Exit T	Stack Exit Velocity	NO_X Short-Term Emission Rate	NO_X Annual Emission Rate	CO Short-Term Emission Rate	CO Annual Emission Rate	$PM_{2.5}$ Short-Term Emission Rate	$PM_{2.5}$ Annual Emission Rate
				m	m	m	m	m	K	m/s	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
B031/B033/B034	031, 033, 034	Project / Aggregated	1b_50	463697	4406490	7.16	83.76 [d]	1.95 [a,d]	429.09 [h]	7.77 [h]	3.15 [i, o]	3.15 [i, o]	3.78 [i, o]	3.78 [i, o]	0.66 [i, o]	0.28 [i, o]
			1b_75					1.95 [a,d]	429.09 [h]	11.66 [h]	4.73 [i, o]	4.73 [i, o]	5.67 [i, o]	5.67 [i, o]	0.98 [i, o]	0.42 [i, o]
			1b_100					1.95 [a,d]	429.09 [h]	15.54 [h]	6.30 [i, o]	6.30 [i, o]	7.56 [i, o]	7.56 [i, o]	1.31 [i, o]	0.56 [i, o]
			2b_50					2.82 [a,h]	431.56 [h]	7.77 [h]	6.30 [i, o]	6.30 [i, o]	7.56 [i, o]	7.56 [i, o]	1.31 [i, o]	0.56 [i, o]
			2b_75					2.82 [a,h]	431.56 [h]	11.66 [h]	9.46 [i, o]	9.46 [i, o]	11.35 [i, o]	11.35 [i, o]	1.97 [i, o]	0.84 [i, o]
			2b_100					2.82 [a,h]	431.56 [h]	15.54 [h]	12.61 [i, o]	12.61 [i, o]	15.13 [i, o]	15.13 [i, o]	2.62 [i, o]	1.11 [i, o]
			3b_50					3.52 [a,h]	434.99 [h]	7.77 [h]	9.46 [i, o]	9.46 [i, o]	11.35 [i, o]	11.35 [i, o]	1.97 [i, o]	0.84 [i, o]
			3b_75					3.52 [a,h]	434.99 [h]	11.66 [h]	14.18 [i, o]	14.18 [i, o]	17.02 [i, o]	17.02 [i, o]	2.95 [i, o]	1.25 [i, o]
			3b_100					3.52 [a,h]	434.99 [h]	15.54 [h]	18.91 [i, o]	18.91 [i, o]	22.69 [i, o]	22.69 [i, o]	3.93 [i, o]	1.67 [i, o]
WWF	C03	Aggregated / Contemporaneous	--	463588	4406759	3.44	61.32 [b,c,d]	0.10 [b,c]	1273 [b]	20 [b]	0.95 [j]	0.95 [j]	4.33 [j]	4.33 [j]	0	0
ME1CF_LP	C01	Project / Aggregated	--	464171	4406974	3.40	39.03 [b,c,d]	0.38 [b,c]	1273 [b]	20 [b]	0.33 [j, o]	0.33 [j, o]	1.48 [j, o]	1.48 [j, o]	0	0
ME1CF_HP	C01	Project / Aggregated	--	464171	4406974	3.40	39.71 [b,c,d]	0.78 [b,c]	1273 [b]	20 [b]	1.34 [j, o]	1.34 [j, o]	6.1 [j, o]	6.1 [j, o]	0	0
ME2CF_LP	C02	Aggregated	--	463932	4406618	6.36	79.13 [b,c,d]	0.60 [b,c]	1273 [b]	20 [b]	0.78 [j]	0.78 [j]	3.58 [j]	3.58 [j]	0	0
ME2XCFLP	C04	Aggregated	--	463814	4407187	5.33	61.54 [b,c,f]	0.61 [b,c]	1273 [b]	20 [b]	0.81 [j]	0.81 [j]	3.69 [j]	3.69 [j]	0	0
ME2XCFHP	C04	Project / Aggregated	--	463814	4407187	5.33	61.19 [b,c,f]	0.50 [b,c]	1273 [b]	20 [b]	0.55 [j, o]	0.55 [j, o]	2.52 [j, o]	2.52 [j, o]	0	0
152BCTC1	139	Aggregated	--	463505	4406891	3.57	17.43 [d]	5.33 [d]	0 [e]	9.92 [m]	0	0	0	0	1.31E-02 [k]	1.31E-02 [k]
152BCTC2	139	Aggregated	--	463511	4406894	3.57	18.59 [d]	5.53 [d]	0 [e]	9.22 [m]	0	0	0	0	1.31E-02 [k]	1.31E-02 [k]
152BCTC3	139	Aggregated	--	463510	4406881	3.56	18.56 [d]	5.67 [d]	0 [e]	8.78 [m]	0	0	0	0	1.31E-02 [k]	1.31E-02 [k]
152BCTC4	139	Aggregated	--	463516	4406884	3.54	18.56 [d]	5.53 [d]	0 [e]	9.22 [m]	0	0	0	0	1.31E-02 [k]	1.31E-02 [k]
152BCTC5	139	Aggregated	--	463516	4406871	3.62	18.59 [d]	5.72 [d]	0 [e]	8.64 [m]	0	0	0	0	1.31E-02 [k]	1.31E-02 [k]
152BCTC6	139	Aggregated	--	463522	4406875	3.57	18.59 [d]	5.67 [d]	0 [e]	8.78 [m]	0	0	0	0	1.31E-02 [k]	1.31E-02 [k]
230119C1	112	Aggregated	--	463999	4406891	3.35	13.69 [d]	5.67 [d]	0 [e]	15.58 [n]	0	0	0	0	8.37E-04 [j]	8.37E-04 [j]
230119C2	112	Aggregated	--	464004	4406881	3.34	13.66 [d]	5.67 [d]	0 [e]	15.58 [n]	0	0	0	0	8.37E-04 [j]	8.37E-04 [j]
230119C3	112	Aggregated	--	464009	4406872	3.31	13.72 [d]	5.67 [d]	0 [e]	15.58 [n]	0	0	0	0	8.37E-04 [j]	8.37E-04 [j]
230119D1	112	Aggregated	--	464265	4406759	3.02	13.99 [d]	5.67 [d]	0 [e]	15.58 [n]	0	0	0	0	4.57E-03 [j]	4.57E-03 [j]
230119D2	112	Aggregated	--	464274	4406766	2.92	13.96 [d]	5.67 [d]	0 [e]	15.58 [n]	0	0	0	0	4.57E-03 [j]	4.57E-03 [j]

Source	Title V Source ID	Source Type	Boiler Scenario	UTME	UTMN	Elevation	Stack Height	Stack Diameter	Stack Exit T	Stack Exit Velocity	NO_X Short-Term Emission Rate	NO_X Annual Emission Rate	CO Short-Term Emission Rate	CO Annual Emission Rate	$PM_{2.5}$ Short-Term Emission Rate	$PM_{2.5}$ Annual Emission Rate
				m	m	m	m	m	K	m/s	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
230119D3	112	Aggregated	--	464283	4406771	2.85	13.93 [d]	5.67 [d]	0 [e]	15.58 [n]	0	0	0	0	4.57E-03 [j]	4.57E-03 [j]
1WSAC1	141	Aggregated	--	463823	4407133	3.65	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
1WSAC2	141	Aggregated	--	463831	4407138	3.64	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
1WSAC3	141	Aggregated	--	463840	4407143	3.75	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
1WSAC4	141	Aggregated	--	463847	4407148	3.94	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
1WSAC5	141	Aggregated	--	463856	4407153	4.24	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
2WSAC1	141	Aggregated	--	463841	4407102	3.47	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
2WSAC2	141	Aggregated	--	463849	4407107	3.36	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
2WSAC3	141	Aggregated	--	463857	4407113	3.36	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
2WSAC4	141	Aggregated	--	463866	4407119	3.38	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]
2WSAC5	141	Aggregated	--	463875	4407124	3.44	8.69 [g]	7.32 [g]	0 [e]	7.82 [g]	0	0	0	0	3.07E-05 [l]	3.07E-05 [l]

[a] Three adjacent Boiler stack vents modeled as a single point source. The equivalent diameters for 2 and 3 stack vents was calculated based on exhaust flow rates from stack test reports.
[b] Based on guidance from the AERSCREEN Model Users Guide (EPA 2021c) Effective stack diameter $d_s = 9.88 \times 10^{-4} (HR*(1-HL))^{0.5}$, effective stack height $h_{eff} = H_s + 4.56 \times 10^{-3}(HR)^{0.478}$, exhaust temperature = 1273K, exit velocity = 20m/s.
where HR is the total heat release rate of the flare sec and HL is the heat loss fraction of 0.55.
[c] Total heat release rates (HR, calculated from constituent flow rates) for each flare in cal/sec: WWF = 24,591; ME1CF_LP = 290,622 ; ME1CF_HP = 1,342,359 ; ME2CF_LP = 807,349; ME2XCFLP = 833,395; ME2XCFHP = 564,599.
[d] A survey of the project site was conducted to collect the as-built heights and diameters of all sources currently present on site.
[e] Ambient exhaust temperature conservatively assumed.
[f] 109911-PM-FEP-3 Report, 109911 ME-2x High/Low Pressure Flare, March 28th, 2019.
[g] Niagara Blower Heat Transfer Solutions, Engineered Heat Transfer Solutions Proposal Drawing for Wet Surface Air Coolers. Exit velocities based on system design to have 4 fans operating at one time.
[h] TVOP 23-00119 Stack Test Reports, 2018, 2021.
[i] Title V Operating Permit 23-00119, Revised August 25th, 2020.
[j] Plan Approval 23-0119E Resubmittal, July 2019.
[k] Cooling Tower Expansion Project RFD 5597, April 2016.
[l] Plan Approval 23-0119J, February 2021
[m] Provided by Burns and McDonnel Engineer February 2023.
[n] Cooling Tower Supplier Data, January 2014.
[o] Ethane Chilling Emissions, 2022.

ATTACHMENT D PM2.5 AIR QUALITY MONITORING LOCATION

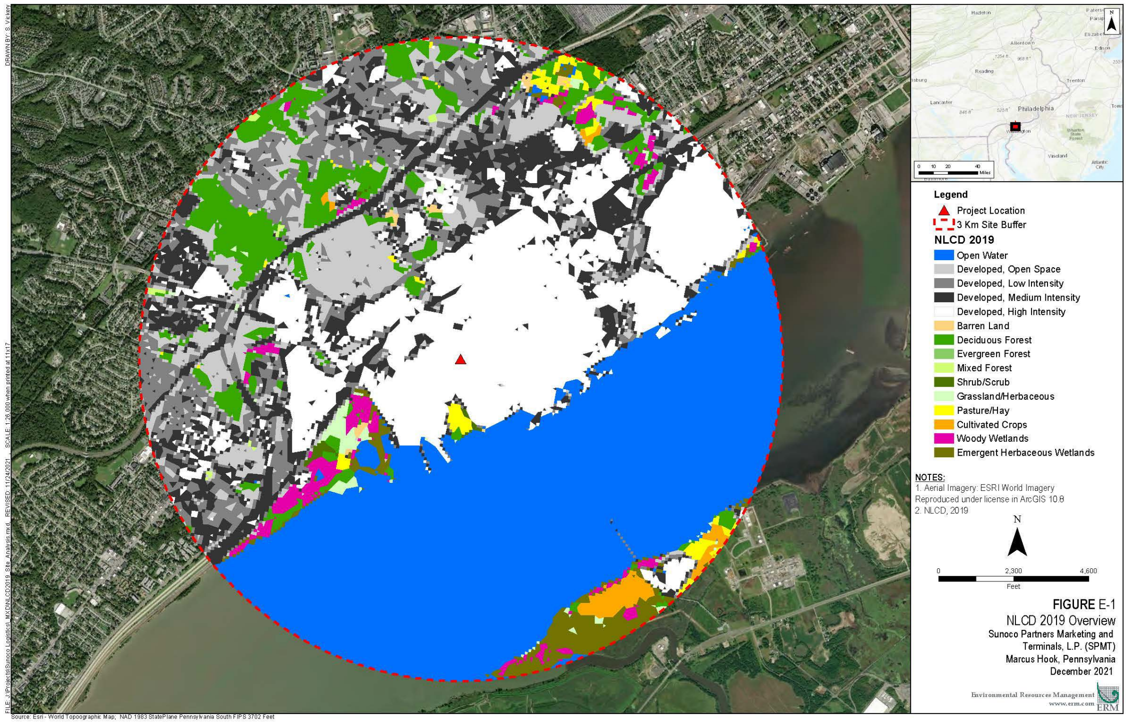
Source:
1) Esri, 2021.

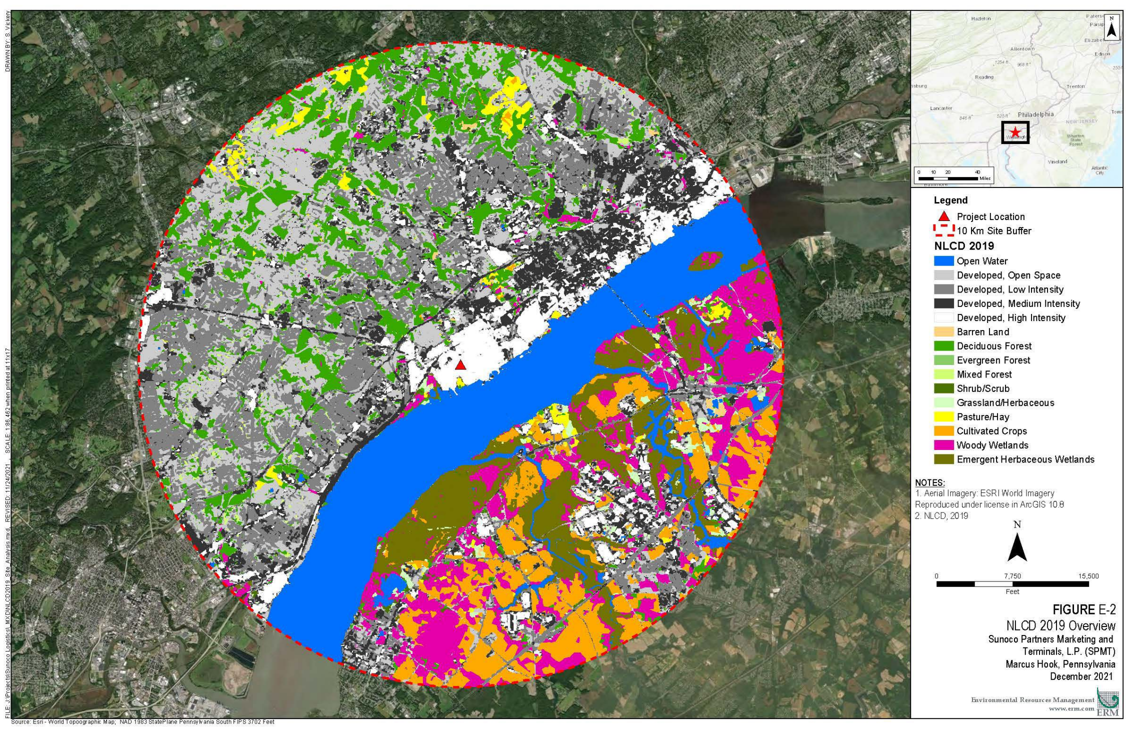
PM2.5 AQS Monitoring Station Location
ETP
Delaware County, Pennsylvania

Topographic Map: ESRI World Imagery. Reproduced under license in ArcGIS 10.8.1

W:\proj_n\MHIC\GIS\MXDs\0364735_100_02_Near_Receptors.mxd - allison.ronan - 12/7/2021

ATTACHMENT E LAND USE CLASSIFICATIONS 3-KM AND 10-KM RADII FROM PROPOSED PROJECT SITE NLCD 2019 LAND USE DATA


Legend
Project Location
3 Km Site Buffer
NLCD 2019
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
NOTES:
1. Aerial Imagery: ESRI World Imagery
Reproduced under license in ArcGIS 10.8
2. NLCD, 2019
N
0
2,300
4,600
Feet
FIGURE E-1
NLCD 2019 Overview
Sunoco Partners Marketing and Terminals, L.P. (SPMT)
Marcus Hook, Pennsylvania
December 2021
Environmental Resources Management
www.erm.com


Legend
Project Location
10 Km Site Buffer
NLCD 2019
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
NOTES:
1. Aerial Imagery: ESRI World Imagery
Reproduced under license in ArcGIS 10.8
2. NLCD, 2019
N
0
7,750
15,500
Feet
FIGURE E-2
NLCD 2019 Overview
Sunoco Partners Marketing and Terminals, L.P. (SPMT)
Marcus Hook, Pennsylvania
December 2021
Environmental Resources Management
www.erm.com

ATTACHMENT F METEOROLOGICAL DATA COMPLETENESS – KPHL – 2016-2020

Meteorological Data Completeness Test

Primary Surface Data:	KPHL / Philadelphia International Airport
Secondary Surface Data:	-----
Upper Air Data:	KIAD / Washington Dulles International Airport

# Total Hours				
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
	01/01 - 03/31	04/01 - 06/30	07/01 - 09/30	10/01 - 12/31
2016	2184	2184	2208	2208
2017	2160	2184	2208	2208
2018	2160	2184	2208	2208
2019	2160	2184	2208	2208
2020	2184	2184	2208	2208

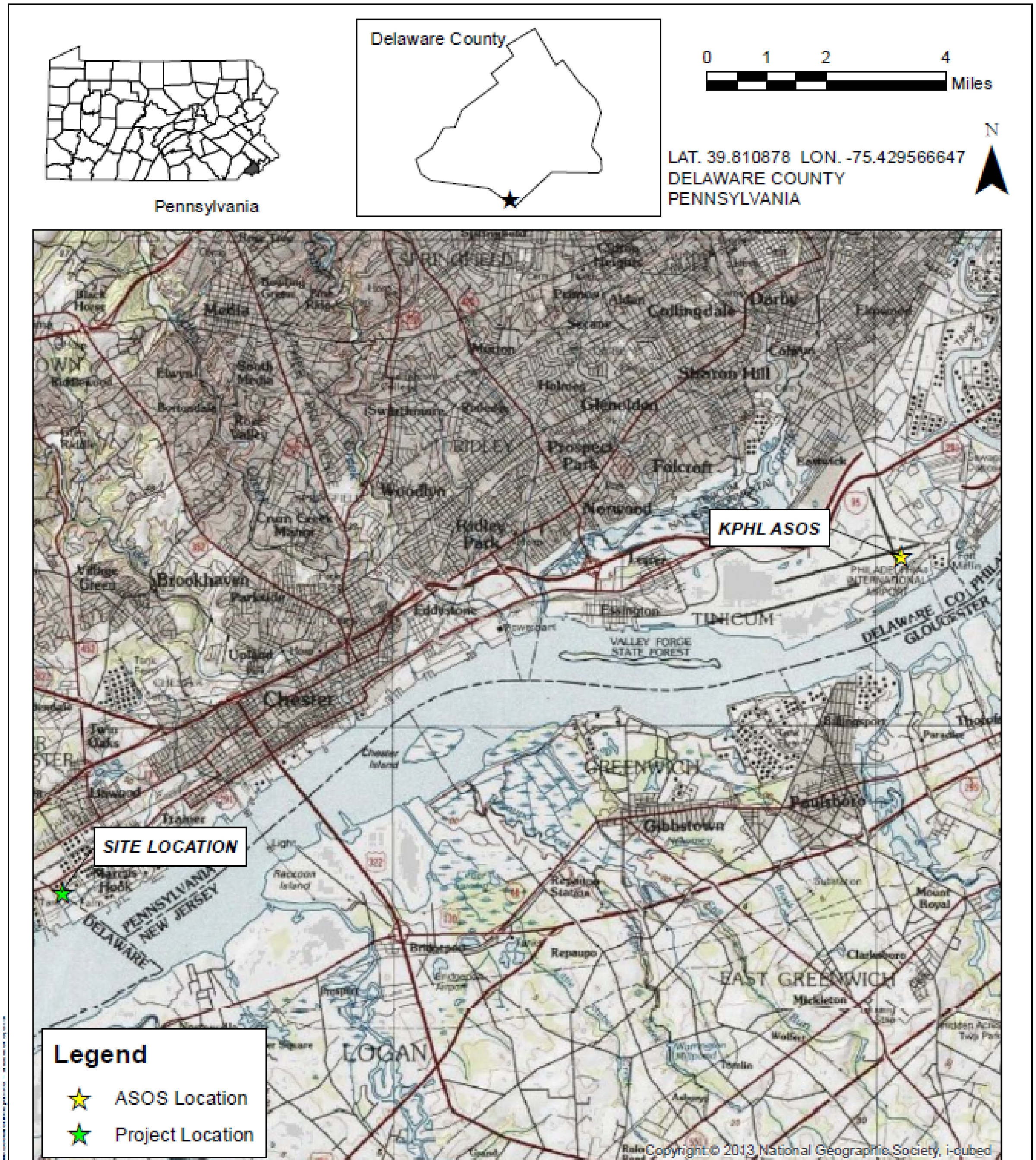
# Missing Hours				
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
	01/01 - 03/31	04/01 - 06/30	07/01 - 09/30	10/01 - 12/31
2016	23	3	3	0
2017	1	11	41	1
2018	1	14	12	35
2019	0	1	6	1
2020	10	0	14	15

% Complete Hours				
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
	01/01 - 03/31	04/01 - 06/30	07/01 - 09/30	10/01 - 12/31
2016	98.95%	99.86%	99.86%	100.00%
2017	99.95%	99.50%	98.14%	99.95%
2018	99.95%	99.36%	99.46%	98.41%
2019	100.00%	99.95%	99.73%	99.95%
2020	99.54%	100.00%	99.37%	99.32%

Test Results				
	Year Average		Quarter Average	
	2016	99.67%	Quarter 1	99.68%
	2017	99.38%	Quarter 2	99.73%
	2018	99.29%	Quarter 3	99.31%
	2019	99.91%	Quarter 4	99.53%
	2020	99.56%		

Pass

ATTACHMENT G LOCATION OF KPHL ASOS STATION AND PROJECT SITE



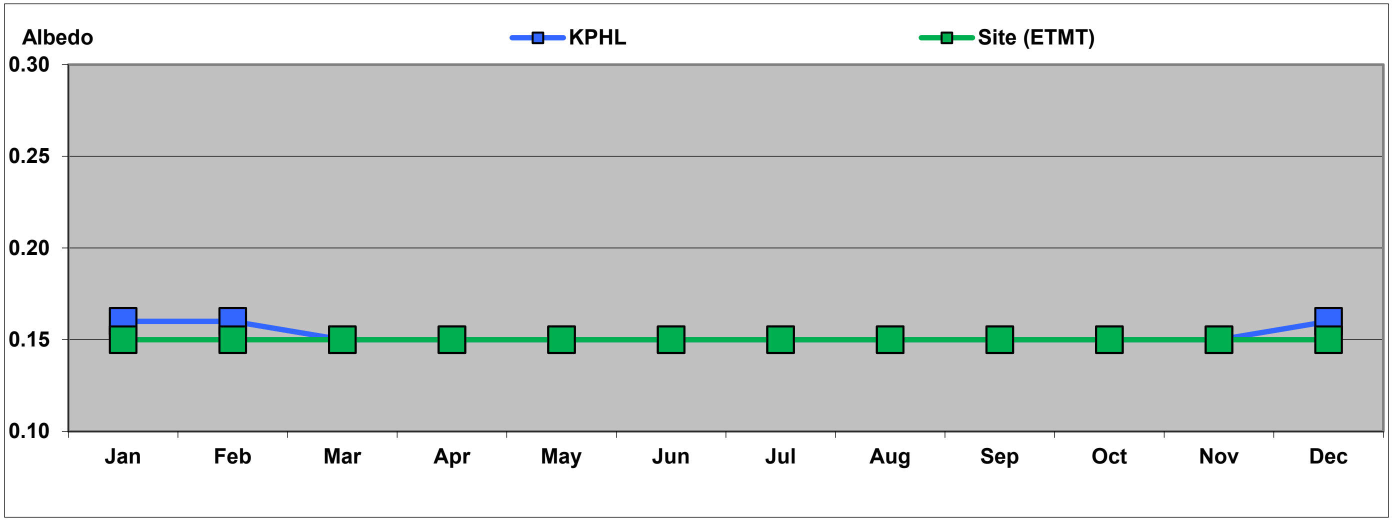
USGS 1:24K 7.5' Quadrangle:
Marcus Hook, PA

SITE LOCATION MAP

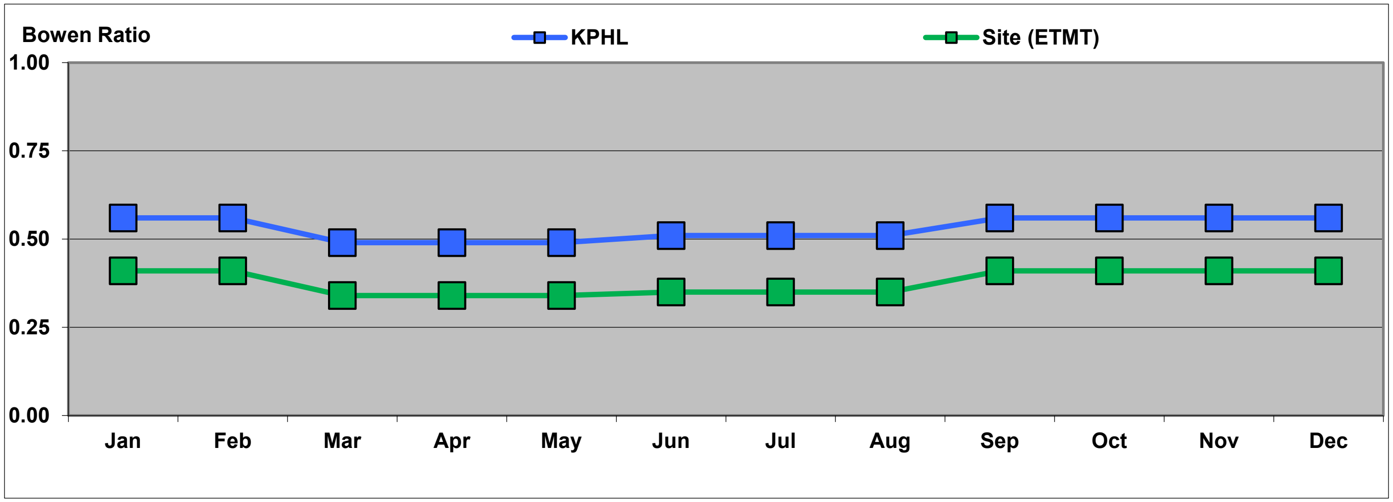
ERM	**Sunoco Partners Marketing & Terminals, L.P. (SPMT)** Sunoco Partners Marketing & Terminals, L.P. (SPMT) Delaware County, Pennsylvania	GIS Review: JR CHK'D: JR 0364735
Drawn By: SRV-12/7/21	**Environmental Resources Management**	ATTACHMENT G

ATTACHMENT H MICROMETEOROLOGICAL VARIABLES COMPARISON KPHL AIRPORT AND PROJECT SITE

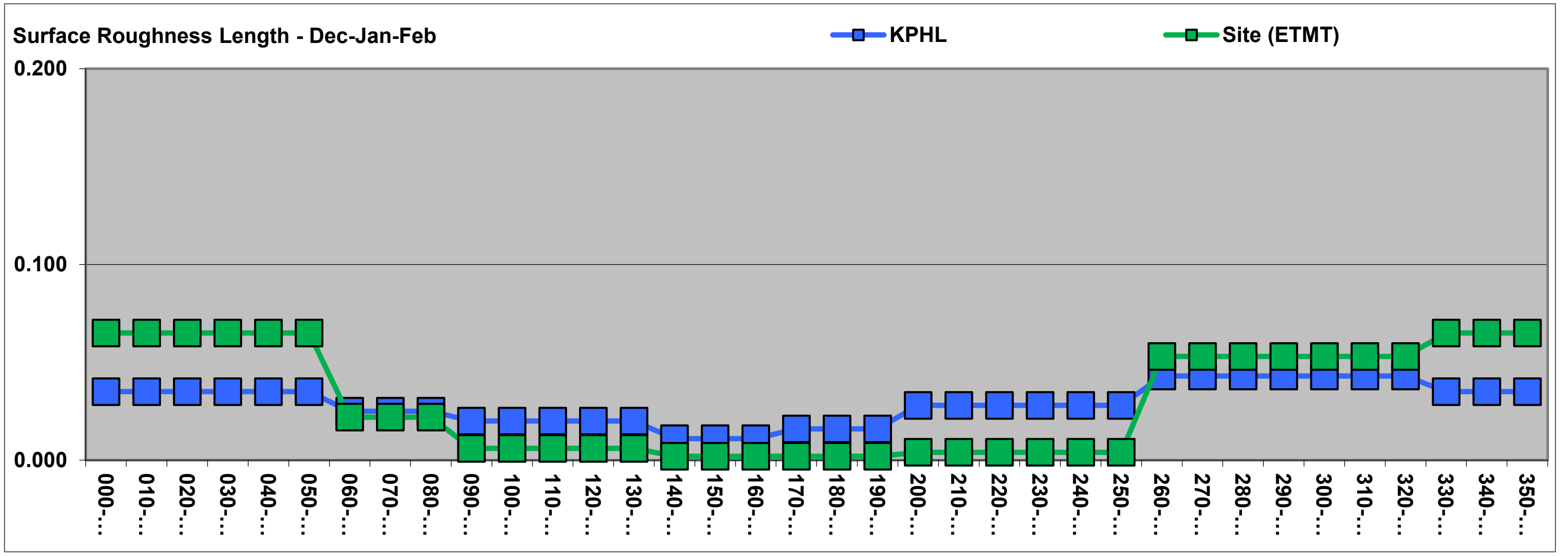
Comparison of Albedo Values

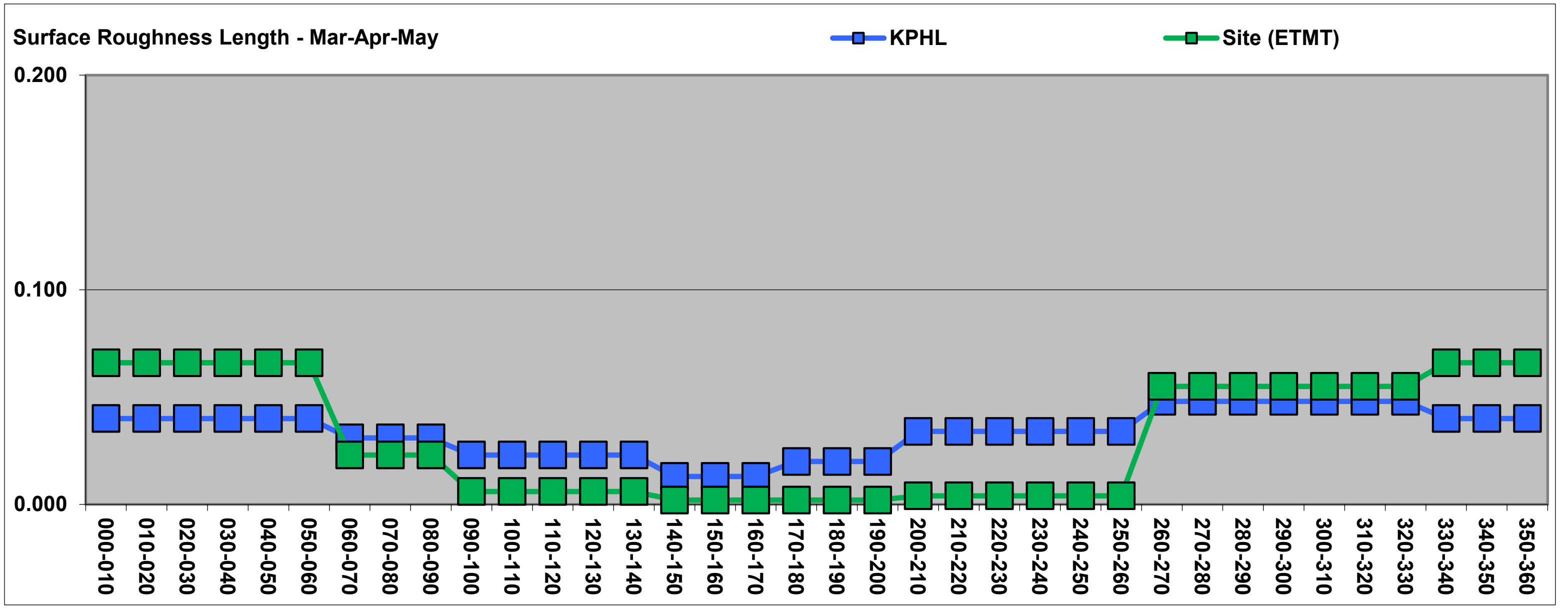


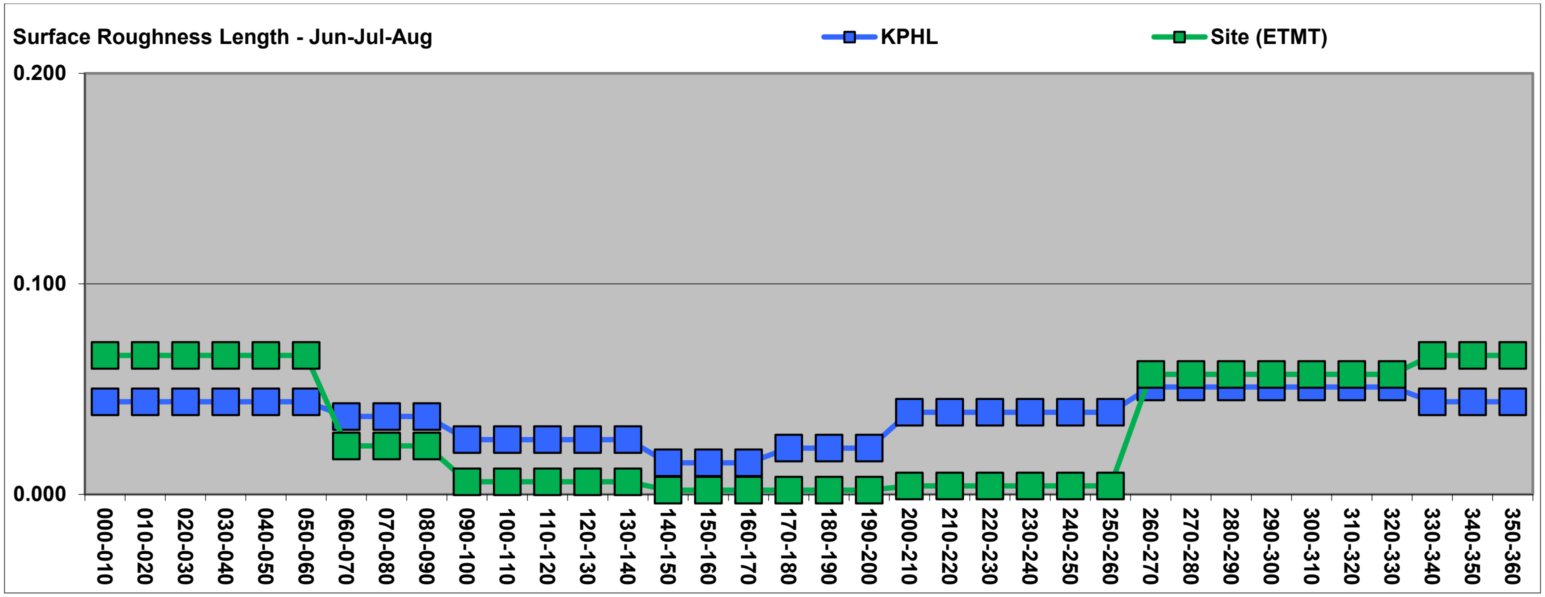
Comparison of Bowen Ratio Values



Comparison of Surface Roughness Lengths






Surface Roughness Length - Jun-Jul-Aug
KPHL
Site (ETMT)
0.200
0.100
0.000
000-010
010-020
020-030
030-040
040-050
050-060
060-070
070-080
080-090
090-100
100-110
110-120
120-130
130-140
140-150
150-160
160-170
170-180
180-190
190-200
200-210
210-220
220-230
230-240
240-250
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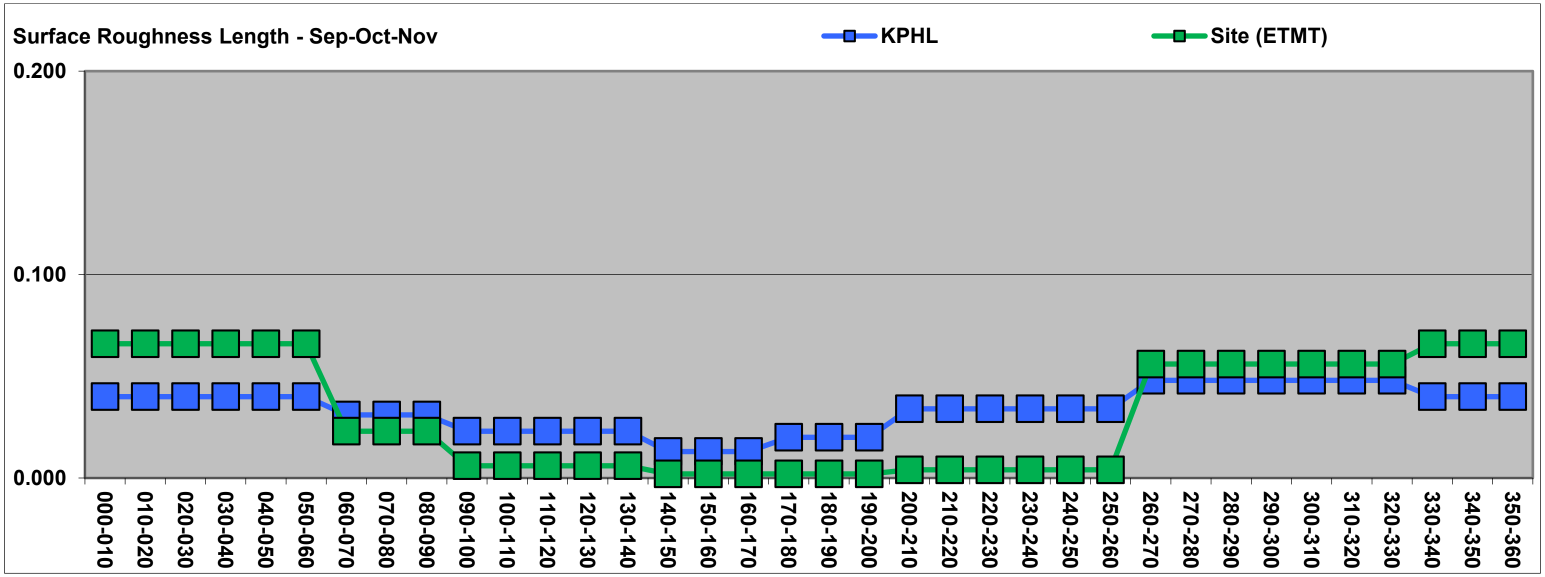
280-290
290-300
300-310
310-320
320-330
330-340
340-350
350-360


Surface Roughness Length - Sep-Oct-Nov
KPHL
Site (ETMT)
0.200
0.100
0.000
000-010
010-020
020-030
030-040
040-050
050-060
060-070
070-080
080-090
090-100
100-110
110-120
120-130
130-140
140-150
150-160
160-170
170-180
180-190
190-200
200-210
210-220
220-230
230-240
240-250
250-260
260-270
270-280
280-290
290-300
300-310
310-320
320-330
330-340
340-350
350-360

ATTACHMENT I DATA SOURCE DOCUMENTATION FOR SOURCE PARAMETERS AND EMISSION RATES

This attachment is submitted as a separate companion document to this report