



**MEMO**

**TO** Alexander Sandy  
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**THROUGH** Andrew W. Fleck *AWF*  
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Bureau of Air Quality

**DATE** December 22, 2025

**RE** Air Quality Analyses for Prevention of Significant Deterioration  
Shell Chemical Appalachia LLC  
Application for Plan Approval 04-00740D  
EMACT Project, WWTP Permanent Controls Project, and Plan  
Approval Reconciliations  
Shell Polymers Monaca Site  
Center Township and Potter Township, Beaver County

**MESSAGE:**

The Pennsylvania Department of Environmental Protection's (DEP) Air Quality Modeling and Risk Assessment Section has completed its technical review of the air quality analyses included in Shell Chemical Appalachia LLC's (Shell) application for Plan Approval 04-00740D for several changes at Shell Polymers Monaca Site in Center Township and Potter Township, Beaver County.

The changes included in Shell's plan approval application are the Ethylene Maximum Achievable Control Technology (EMACT) Project to comply with the revised 40 CFR 63 Subpart YY, the Wastewater Treatment Plant (WWTP) Permanent Controls Project to install

permanent equipment to improve oil, grease, and volatile organic compounds removal from the wastewater, and the reconciliations of plan approval source descriptions and conditions as well as potential to emit calculations, referred herein as “Plan Approval Reconciliations”, based on Shell’s latest review of its “as-built” equipment and operations.

The EMACT Project would be a major modification to an existing major stationary source and therefore subject to the Prevention of Significant Deterioration (PSD) regulations, which requires Shell to conduct air quality analyses. At the request of the DEP, Shell revised its air quality analyses for PSD previously conducted to support its application for Plan Approval 04-00740C to account for emissions revisions associated with the WWTP Permanent Controls Project and Plan Approval Reconciliations.

During its technical review, the DEP made several revisions to Shell’s air quality analyses for PSD involving the WWTP Permanent Controls Project and Plan Approval Reconciliations while no changes were made to the air quality analyses for PSD for the EMACT Project. The DEP’s technical review concludes that Shell’s air quality analyses for both the EMACT Project and for the WWTP Permanent Controls Project and Plan Approval Reconciliations, in conjunction with the revisions made, satisfy the requirements of the PSD regulations. The DEP’s summary of Shell’s air quality analyses for PSD, along with the DEP’s revisions, is attached.

If you have any questions regarding Shell’s air quality analyses for PSD, you may contact me ([hbonifacio@pa.gov](mailto:hbonifacio@pa.gov), 717.772.5968) or Andrew Fleck ([afleck@pa.gov](mailto:afleck@pa.gov), 717.783.9243).

Attachment

cc: Mark Gorog, SWRO/Air Quality  
Sheri Guerrieri, SWRO/Air Quality/New Source Review  
Nicholas Lazor, BAQ/Director  
Viren Trivedi, BAQ/Permits  
Sean Wenrich, BAQ/Permits/New Source Review  
Stephen Steirer, BAQ/Permits/Air Quality Modeling and Risk Assessment

DEP Summary of Air Quality Analyses for Prevention of Significant Deterioration  
Shell Chemical Appalachia LLC  
Application for Plan Approval 04-00740D  
EMACT Project, WWTP Permanent Controls Project, and Plan Approval Reconciliations  
Shell Polymers Monaca Site, Center Township and Potter Township, Beaver County  
December 22, 2025

## I. Background

The Pennsylvania Department of Environmental Protection (DEP) received a plan approval application on September 13, 2024, from Shell Chemical Appalachia LLC (Shell) for several changes at Shell Polymers Monaca Site in Center Township and Potter Township, Beaver County.<sup>1</sup> The changes included are the Ethylene Maximum Achievable Control Technology (EMACT) Project to comply with the revised 40 CFR 63 Subpart YY, the Wastewater Treatment Plant (WWTP) Permanent Controls Project to install permanent equipment to improve oil, grease, and volatile organic compounds removal from the wastewater, and the reconciliations of plan approval source descriptions and conditions as well as potential to emit (PTE) calculations, referred herein as “Plan Approval Reconciliations,” based on Shell’s latest review of its “as-built” equipment and operations. The plan approval application and included air quality analyses were prepared by Landau Associates, on behalf of Shell. On October 10, 2024, the DEP’s Southwest Regional Office (SWRO) notified Shell that its plan approval application was administratively complete.<sup>2</sup> In response to the DEP’s December 20, 2024,<sup>3</sup> and July 7, 2025,<sup>4</sup> technical review comments, the DEP received revised air quality analyses and emissions/emission rates calculations from Shell on May 29, 2025,<sup>5,6</sup> and September 5, 2025,<sup>7,8</sup> respectively.

## II. Regulatory Applicability

Shell’s EMACT Project would be a major modification<sup>9</sup> to an existing major stationary source<sup>10</sup> and therefore subject to the Prevention of Significant Deterioration (PSD) regulations codified in 40 CFR § 52.21. These federal PSD regulations are adopted and incorporated by reference in their entirety in 25 Pa. Code § 127.83 and the Commonwealth’s State Implementation Plan (SIP) codified in 40 CFR § 52.2020.

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<sup>1</sup> Letter with enclosure (Plan Approval Application for Shell Polymers Monaca) from James Howell, Shell to Mark Gorog, DEP/SWRO/Air Quality. September 13, 2024.

<sup>2</sup> Letter from Alexander Sandy, DEP/SWRO/Air Quality/New Source Review to Kimberly Kaal, Shell. October 10, 2024.

<sup>3</sup> Letter with enclosure from Henry F. Bonifacio and Stephen J. Steirer, DEP/BAQ/Permits/Air Quality Modeling and Risk Assessment to Kimberly Kaal, Shell. December 20, 2024.

<sup>4</sup> Email with attachment from Henry F. Bonifacio, DEP/BAQ/Permits/Air Quality Modeling and Risk Assessment to Michael Carbon, Landau Associates. July 7, 2025.

<sup>5</sup> Letter with enclosures from Kimberly Kaal, Shell to Alexander Sandy, DEP/SWRO/Air Quality/New Source Review. May 29, 2025.

<sup>6</sup> Email with link to files associated with PSD air quality analyses from Michael Carbon, Landau Associates. May 29, 2025.

<sup>7</sup> Letter with enclosures from Kimberly Kaal, Shell to Mark Gorog, DEP/SWRO/Air Quality. September 5, 2025.

<sup>8</sup> Email with link to files associated with PSD air quality analyses from Michael Carbon, Landau Associates. September 5, 2025.

<sup>9</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(2). Definition of “major modification.”

<sup>10</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(1). Definition of “major stationary source.”

For PSD applicability purposes, Shell’s net emissions increase<sup>11</sup> from the proposed major modification equals or exceeds the PSD significant emission rates (SER)<sup>12</sup> for carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), particulate matter less than or equal to 2.5 micrometers in aerodynamic diameter (PM-2.5), and greenhouse gases (GHGs, as carbon dioxide equivalent (CO<sub>2</sub>e)) but do not exceed the PSD SER for particulate matter (PM), particulate matter less than or equal to 10 micrometers in aerodynamic diameter (PM-10), sulfur dioxide (SO<sub>2</sub>),<sup>13</sup> lead (Pb), and sulfuric acid mist (H<sub>2</sub>SO<sub>4</sub>). Shell is required to conduct air quality analyses for CO, NO<sub>x</sub>, and PM-2.5. Shell’s net emissions increase for the EMACT Project is summarized in Table 1a.

Table 1a: Shell’s Net Emissions Increase for the EMACT Project

Pollutant	Proposed Major Modification Net Emissions Increase	PSD Significant Emission Rate
	tpy	tpy
CO	349.37	100
NO <sub>x</sub>	76.64	40
SO <sub>2</sub>	1.66	40
PM (filterable only)	2.10	25
PM-10	8.40	15
PM-2.5	8.40	10 of direct PM-2.5, 40 of SO <sub>2</sub> , or 40 of NO <sub>x</sub>
Pb	5.52E-04	0.6
H <sub>2</sub> SO <sub>4</sub>	0.08	7
GHGs	98,238	75,000

Shell’s proposal to construct Shell Polymers Monaca Site was subject to the PSD regulations and initially authorized under Plan Approval 04-00740A, which was issued by the DEP on June 18, 2015. Emissions subject to PSD review included CO, NO<sub>x</sub>, PM, PM-10, H<sub>2</sub>SO<sub>4</sub>, and GHGs. Subsequently, “as-built” changes in design and construction of Shell Polymers Monaca Site were authorized under Plan Approval 04-00740C, which was issued by the DEP on February 18, 2021. For this plan approval application, Shell also revised the potential to emit (PTE)<sup>14</sup> for Shell Polymers Monaca Site to account for the WWTP Permanent Controls Project and for Plan Approval Reconciliations. Shell’s revised PTE still equals or exceeds the PSD SER for CO, NO<sub>x</sub>, PM, PM-10, and GHGs. At the request of the DEP in accordance with 25 Pa. Code § 127.12(a)(2), Shell revised its PSD air quality analyses for CO, NO<sub>x</sub>, and PM-10 to account for the revised PTE. Shell’s revised PTE is summarized in Table 1b.

<sup>11</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(3). Definition of “net emissions increase.”

<sup>12</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(23). Definition of “significant.”

<sup>13</sup> Beaver County was redesignated as attainment for the 2010 1-hour SO<sub>2</sub> National Ambient Air Quality Standard (NAAQS) effective December 18, 2025. 90 FR 51560. Air Plan Approval; Pennsylvania; Redesignation of the Beaver County Nonattainment Area to Attainment and Approval of the Area’s Maintenance Plan for the 2010 1-Hour Primary Sulfur Dioxide National Ambient Air Quality Standard. November 18, 2025.

<sup>14</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(4). Definition of “potential to emit.”

Table 1b: Shell’s Revised Potential To Emit (PTE) that Accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations

Pollutant	Proposed Revised PTE	PSD Significant Emission Rate
	tpy	tpy
CO	864.98	100
NO <sub>x</sub>	378.49	40
PM (filterable only)	76.29	25
PM-10	175.81	15
H <sub>2</sub> SO <sub>4</sub>	1.24	7
GHGs	2,468,325	75,000

Relevant to 40 CFR § 52.21(k) through (p) of the PSD regulations, Shell’s plan approval application included the following air quality analyses:

- Source impact analyses of the net emissions increase of CO, NO<sub>x</sub>, and PM-2.5 due to the EMACT Project;<sup>15</sup>
- Source impact analyses of the revised PTE of CO, NO<sub>x</sub>, and PM-10 that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations;<sup>16</sup>
- Additional impact analyses of the impairment to visibility, soils, and vegetation that accounts for the net emissions increase due to the EMACT Project, the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations, and associated growth; and
- Initial screening calculations to determine whether the net emissions increase from the EMACT Project, in conjunction with the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations, would have negligible impacts on air quality related values (AQRV) and visibility in nearby federal Class I areas.

### III. Air Dispersion Modeling for Source Impact Analyses

Shell provided a detailed description of the air dispersion modeling methodology for the PSD air quality analyses for the EMACT Project and for the WWTP Permanent Control Project and Plan Approval Reconciliations in section 4 (Model Selection and Model Input) and section 5 (Modeling Methodology) in Appendix D-1 (Air Dispersion Modeling and Class II Visibility Analysis for Shell Polymers Monaca) of the plan approval application. For the EMACT Project,

<sup>15</sup> Source impact analyses for the net emissions increase for the EMACT Project consisted of significant impact level (SIL) analyses only. No cumulative NAAQS and PSD increment analyses were conducted because none of the SILs were exceeded.

<sup>16</sup> Source impact analyses for the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations consisted of both SIL analyses and, because SILs were exceeded based on SIL analyses, cumulative impact analyses. Cumulative NAAQS and PSD increment analyses conducted for the revised PTE also reflected the impacts of net emissions increase due to the EMACT Project.

the air dispersion modeling methodology was based on Shell's modeling protocol,<sup>17</sup> which was approved by the DEP on June 6, 2024.<sup>18</sup>

## A. Model Selection

Shell's air dispersion modeling utilized the American Meteorological Society (AMS) / U.S. Environmental Protection Agency's (EPA) Regulatory Model (AERMOD) v24142. AERMOD is the EPA's required near-field air dispersion model for a wide range of regulatory applications in all types of terrain and for aerodynamic building downwash.<sup>19</sup>

## B. Model Input

### 1. Control Pathway

AERMOD was executed with regulatory default options to calculate concentrations for each applicable pollutant and averaging time.

AERMOD was executed with rural dispersion, by default, based on the EPA's recommended Land Use Procedure.<sup>20,21</sup> The EPA's Land Use Procedure was conducted by evaluating National Land Cover Database (NLCD) land cover data for 2021 from the U.S. Geological Survey (USGS) Multi-Resolution Land Characteristics Consortium (MRLC). NLCD land cover code 23 (Developed, Medium Intensity) and land cover code 24 (Developed, High Intensity) were considered to be equivalent to Auer<sup>22</sup> land use types that are classified as urban by the EPA's Land Use Procedure, whereas the remaining NLCD land cover codes were considered to be equivalent to Auer land use types that are classified as rural. The land cover within three (3) kilometers of Shell Polymer Monaca Site is predominantly rural and would not significantly contribute to an urban heat island effect. Shell provided a detailed description that justifies the use of rural dispersion in subsection 4.2 (Model Control Options and Land Use) of Appendix D-1 of the plan approval application.

For NO<sub>x</sub> to NO<sub>2</sub> conversion, Shell used a different regulatory default option for each analysis. For Class II Area and Class I Area Significant Impact Level (SIL) analyses, Shell utilized the Tier 2 Ambient Ratio Method – 2 (ARM2) with the EPA-recommended minimum and maximum

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<sup>17</sup> Email with attachment (Air Dispersion Modeling Protocol for the Proposed Major Modification at the Shell Chemical Appalachia Petrochemicals Complex in Beaver County Pennsylvania) from David Keen, RTP Environmental Associates to Andrew Fleck, DEP/BAQ/Permits/Air Quality Modeling and Risk Assessment. June 5, 2024.

<sup>18</sup> Letter from Henry Bonifacio, DEP/BAQ/Permits/Air Quality Modeling and Risk Assessment to David Keen, RTP Environmental Associates. June 6, 2024.

<sup>19</sup> *Code of Federal Regulations*. 40 CFR Part 51, Appendix W (Guideline on Air Quality Models). Subsection 4.2.2.1(a).

<sup>20</sup> *Code of Federal Regulations*. 40 CFR Part 51, Appendix W (Guideline on Air Quality Models). Subsection 7.2.1.1(b)(i).

<sup>21</sup> AERMOD Implementation Guide (EPA-454/B-24-009, November 2024). Subsection 5.1.

<sup>22</sup> Auer, Jr., A.H., 1978. Correlation of Land Use and Cover with Meteorological Anomalies. *Journal of Applied Meteorology*, 17(5): 636–643.

ambient NO<sub>2</sub>/NO<sub>x</sub> ratios of 0.5 and 0.9, respectively.<sup>23</sup> For 1-hour NO<sub>2</sub> and annual NO<sub>2</sub> NAAQS analyses, Shell utilized the Tier 3 Plume Volume Molar Ratio Method (PVMRM). When the Tier 3 PVMRM was a non-regulatory option, its use as an alternative model in Shell's air quality analyses to support its application for Plan Approval 04-00740A was requested by the DEP based on Shell's proposal and was subsequently approved by the EPA.<sup>24,25</sup> Shell discussed its implementation of the Tier 3 PVMRM, i.e., NO<sub>2</sub>/NO<sub>x</sub> in-stack ratios, hourly background ozone data, in subsection 5.7 (NO<sub>2</sub> Analyses) of Appendix D-1 of the plan approval application. For the annual NO<sub>2</sub> PSD Class II increment analysis, Shell utilized the Tier 1 approach by assuming 100% NO<sub>x</sub> to NO<sub>2</sub> conversion.

## 2. Source Pathway

### a. Source Characterization

Shell modeled its sources as either point sources, horizontal point sources, or volume sources. Sources at Shell that emit CO, NO<sub>x</sub>, PM-10, and/or PM-2.5 and their corresponding source types used in the analyses are listed in Table 2. Among these sources, only the two (2) totally enclosed ground flares are included in the EMACT Project.

Table 2: Shell's Emission Sources and Their Source Types

Emission Source(s)	Pollutants	Source Type <sup>[a]</sup>
Two (2) totally enclosed ground flares	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
One (1) elevated, steam-assisted flare	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
One (1) multi-point ground flare that consists of 38 flare heads	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
Seven (7) ethane cracking furnaces	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
Three (3) combustion turbines with duct burners	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
One (1) continuous vent thermal oxidizer	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
One (1) spent caustic thermal oxidizer	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
Two (2) diesel-fired fire water pumps engines	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
Two (2) diesel-fired emergency generator engines	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
Two (2) natural gas-fired emergency generator engines	CO, NO <sub>x</sub> , PM-10, PM-2.5	Point
One (1) process cooling tower with 26 cells	PM-10, PM-2.5	Point

<sup>23</sup> *Code of Federal Regulations*. 40 CFR Part 51, Appendix W (Guideline on Air Quality Models). Subsection 4.2.3.4(d).

<sup>24</sup> Letter with enclosure (Request to Use the Plume Volume Molar Ratio Method in AERMOD Air Quality Analysis for Shell Chemical Appalachia LLC Proposed Ethane Cracker and Polyethylene Manufacturing Facility) from E. Christopher Abruzzo, DEP to Shawn M. Garvin, EPA Region III. March 31, 2014.

<sup>25</sup> Letter from Shawn M. Garvin, EPA Region III to E. Christopher Abruzzo/DEP. April 21, 2014.

Emission Source(s)	Pollutants	Source Type <sup>[a]</sup>
One (1) cogeneration plant cooling tower with 6 cells	PM-10, PM-2.5	Point
Three (3) polyethylene (PE) manufacturing lines <sup>[b]</sup>	PM-10, PM-2.5	Point
Filter vents <sup>[c]</sup>	PM-10, PM-2.5	Horizontal Point
Pellet dryer vent	PM-10, PM-2.5	Point
Rail to truck talc transfer	PM-10, PM-2.5	Point
PE Railcar loading	PM-10, PM-2.5	Volume
PE Truck loading	PM-10, PM-2.5	Volume
PE Blending silos	PM-10, PM-2.5	Volume
Two (2) PE manufacturing lines <sup>[d]</sup>	PM-10, PM-2.5	Volume
One (1) PE manufacturing line <sup>[e]</sup>	CO	Volume
Nine (9) ethylene manufacturing equipment components	CO	Volume
Plant roadways for transport trucks and talc trucks	PM-10, PM-2.5	Volume

<sup>[a]</sup> The Point source type is a point source with an unobstructed vertical stack. The Horizontal Point source type is a point source with a horizontal exit air direction.

<sup>[b]</sup> Two (2) manufacturing lines' emission points modeled as point sources are two (2) shared catalyst filter vents. The last manufacturing line's emission points modeled as point sources are two (2) catalyst activator filter vents.

<sup>[c]</sup> Filter vents for the following: Additive Unloading Stations A, B, C, and D; FIBC compactor filter vent; Additive Feeders A, B, C, and D; Extruder; and Vacuum Cleaning System.

<sup>[d]</sup> Two (2) manufacturing lines' emission points modeled as volume sources are two (2) process vents, one vent for each line.

<sup>[e]</sup> Fugitives from the Kill Gas System.

## b. Emission Data

The emission rates and associated parameters, i.e., locations, elevations, point source/stack parameters, and/or volume source parameters, entered in AERMOD for each of Shell's sources are consistent with those provided in Shell's plan approval application. The sources' emission rates and associated parameters are summarized in tables in Appendix B (Potential to Emit Calculations) and Appendix D-1's Attachment A (Modeled Source Input Data), respectively, of the plan approval application.

For flares, their effective diameters and heights were approximated following the formulations described in the AERSCREEN User's Guide.<sup>26</sup> Shell provided a detailed description of the flare's effective diameter and height calculations in subsection 4.3 (Source and Monitoring Data) of Appendix D-1 of the plan approval application. Also described in subsection 4.3 is the calculation of volume source parameters used for the plant roadways.

<sup>26</sup> AERSCREEN User's Guide (EPA-454/B-21-005, April 2021). Subsection 2.1.2.

Shell conducted three (3) operating scenario analyses with AERMOD. First was the combustion turbine load analysis to determine which among the load conditions (i.e., 100%, 75%, and 45%) would result in the worst-case impact for each averaging period evaluated. Second was the ethane cracking furnace mode analysis to determine which among the ethane cracking furnaces' operation modes (i.e., maximum normal, minimum normal, decoking, feed in/feed out, hot steam standby, and startup/shutdown) would result in the worst-case impact for each pollutant (i.e., CO, NO<sub>x</sub>, PM-10) and its associated National Ambient Air Quality Standards (NAAQS) averaging periods. Third was the worst-case ethane cracking furnace analysis to determine which among the seven (7) ethane cracking furnaces would result in the worst-case impact for 1-hour and 8-hour averaging periods. Shell described the procedures for these operating scenario analyses in subsections 5.2 (Combustion Turbine Load Analysis) and 5.3 (Ethane Cracking Furnace Modes and Worst-Case Operating Conditions) of Appendix D-1 of the plan approval application.

#### c. Good Engineering Practice Stack Height and Downwash

Stack heights of sources modeled as point sources and horizontal point sources were fully creditable for entry in AERMOD since none exceeded their corresponding Good Engineering Practice (GEP) stack height,<sup>27</sup> i.e., the greater of 65 meters or the GEP formula stack height. Additionally, direction-specific building downwash parameters were entered in AERMOD for each point source and horizontal point source. The GEP formula stack height and direction-specific building downwash parameters were calculated using the EPA's Building Profile Input Program for the Plume Rise Model Enhancements algorithm (BPIPFRM) v04274. It is noted that according to the EPA, flares are excluded from the GEP stack height regulations.<sup>28</sup>

Shell discussed the GEP stack height calculation and use of BPIPFRM to calculate GEP stack heights and building downwash parameters in subsection 4.3 (Source and Monitoring Data) of Appendix D-1 of the plan approval application.

In the DEP's confirmation runs, building downwash parameters for four (4) sources (i.e., identified in Shell's dispersion modeling by AERMOD Source ID GEN1, COI, COLTW7a, EXTRUD) were corrected.<sup>29</sup> The DEP also corrected the locations for two (2) sources (i.e., AERMOD Source ID CAA and CAB) in Shell's NAAQS analyses for 1-hour CO, 8-hour CO, 1-hour NO<sub>2</sub>, and annual NO<sub>2</sub> to agree with the information documented in Attachment A (Modeled Source Input Data) of Appendix D-1 of the plan approval application and the settings used in the rest of the cumulative impact analyses.

#### d. Nearby Emission Sources and Modeled Component of Background Concentrations

In the 1-hour CO, 8-hour CO, 1-hour NO<sub>2</sub>, annual NO<sub>2</sub>, and 24-hour PM-10 NAAQS analyses, the modeled components of the CO, NO<sub>2</sub>, and PM-10 background concentrations were calculated by the inclusion in AERMOD of source data that represent emission sources from existing

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<sup>27</sup> *Code of Federal Regulations*. 40 CFR § 51.100(ii). Definition of "good engineering practice stack height."

<sup>28</sup> Questions and Answers on Implementing the Revised Stack Height Regulation. EPA memorandum from G.T. Helms, Control Program Operations Branch (MD-15) to Chief, Air Branch, Regions 1-X. October 10, 1985.

<sup>29</sup> In its confirmation run using the EPA's BPIPFRM, the DEP did not make any revisions to building parameters (dimensions, locations, elevations) and source parameters (stack heights, locations, elevations) as provided by Shell.

nearby facilities. For the 1-hour CO, 8-hour CO, annual, NO<sub>2</sub>, 24-hour PM-10, and annual PM-10 NAAQS analyses, these facilities include all major and minor sources located within 20 km of Shell Polymers Monaca Site. For the 1-hour NO<sub>2</sub> NAAQS analysis, these facilities include all major and minor sources located within 37 km of Shell Polymers Monaca Site. Attachment A of Appendix D-1 of the plan approval application includes several tables summarizing the units of nearby sources modeled, their emission rates (i.e., CO, PM-10, 1-hour NO<sub>2</sub>, annual NO<sub>2</sub>) and associated parameters entered in AERMOD.

#### e. PSD Increment Affecting Sources

The NO<sub>2</sub> major source baseline date<sup>30</sup> and the NO<sub>2</sub> trigger date<sup>31</sup> are both February 8, 1988.<sup>32,33</sup> In the annual NO<sub>2</sub> Class II Area PSD increment analysis, the source data used in the annual NO<sub>2</sub> NAAQS analysis to represent emission sources for existing nearby facilities were included in AERMOD to conservatively represent potential NO<sub>2</sub> increment-consuming emissions.

The PM-10 major source baseline date is January 6, 1975<sup>34</sup> and the PM-10 trigger date is August 7, 1977.<sup>35</sup> In the 24-hour PM-10 and annual PM-10 Class II Area PSD increment analyses, the source data used in the 24-hour PM-10 NAAQS analysis to represent emission sources for existing nearby facilities were included in AERMOD to conservatively represent potential 24-hour PM-10 and annual PM-10 increment-consuming emissions.

The PM-2.5 major source baseline date is October 20, 2010<sup>36</sup> and the PM-2.5 trigger date is October 20, 2011.<sup>37</sup> Previously designated as nonattainment for the 1997 annual PM-2.5 and 2006 24-hour PM-2.5 NAAQS, Beaver County was redesignated as unclassifiable/attainment for both standards effective October 2, 2015.<sup>38</sup> The PM-2.5 minor source baseline date<sup>39</sup> for the PM-2.5 baseline area<sup>40</sup> that includes all of Beaver County is October 6, 2023, established by IPSCO Koppel Tubulars, LLC's application for Plan Approval 04-00059E. Identification of potential PM-2.5 increment-affecting emissions was not conducted because cumulative impact analyses for the PM-2.5 Class II Area PSD increments were not necessary, as discussed below.

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<sup>30</sup> New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting (EPA Draft, October 1990). Page C.6.

<sup>31</sup> Ibid. Page C.6.

<sup>32</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(14)(i)(b). Definition of "major source baseline date."

<sup>33</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(14)(ii)(b). Definition of "trigger date."

<sup>34</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(14)(i)(a). Definition of "major source baseline date."

<sup>35</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(14)(ii)(a). Definition of "trigger date."

<sup>36</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(14)(i)(c). Definition of "major source baseline date."

<sup>37</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(14)(ii)(c). Definition of "trigger date."

<sup>38</sup> *Federal Register*. 80 FR 59624. Approval and Promulgation of Air Quality Implementation Plans; Pennsylvania; Redesignation Request and Associated Maintenance Plan for the Pittsburgh-Valley Nonattainment Area for the 1997 Annual and 2006 24-Hour Fine Particulate Matter Standard. October 2, 2015.

<sup>39</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(14)(ii). Definition of "minor source baseline date."

<sup>40</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(15)(i). Definition of "baseline area."

### 3. Receptor Pathway

#### a. Receptors

Receptors were entered in AERMOD at locations defined to be ambient air.<sup>41,42</sup> The extent and density of Shell's receptor domain in AERMOD were adequate to determine the location and magnitude of the maximum concentrations in the Class II Area and Class I Area SIL analyses and the design concentrations in the NAAQS and Class II Area PSD increment analyses.

In the Class II Area SIL analyses, receptors were entered in AERMOD within a 103- by 103-kilometer Cartesian grid centered on Shell Polymers Monaca Site. Receptor density decreased with distance from Shell Polymers Monaca Site. Additionally, receptors with flagpole heights were entered in AERMOD to represent the elevation of the Highway 376 Bridge deck east of the facility. Shell provided a detailed description of AERMOD's Class II Area receptor domain in subsection 4.4 (Receptor Data) of Appendix D-1 of the plan approval application.

In the NAAQS and Class II Area PSD increment analyses, only receptors with modeled impacts greater than each pollutant's respective SIL(s) were included in AERMOD. During the technical review, the DEP corrected the numbers of receptors that were carried through to cumulative impact analyses.

In the Class I Area SIL analyses, different sets of receptors were used. Receptors were first entered in AERMOD spaced one degree apart in an arc at a distance of 50 kilometers<sup>43</sup> in the direction of the nearby federal Class I areas, i.e., Dolly Sods Wilderness and Otter Creek Wilderness in West Virginia, Shenandoah National Park and James River Face Wilderness in Virginia. Elevations (i.e., minimum, maximum, and average) at the Class I areas were then accounted for at each receptor by assigning a set of flagpole heights, with the flagpole height calculated as the difference between a Class I area elevation (i.e., minimum, maximum, or average) and the actual elevation of the receptor. If any of the initial receptors had modeled impacts greater than a pollutant's respective Class I Area SIL(s), receptors were then entered in AERMOD spaced one degree apart in multiple arcs at distances of 10, 20, 30, 40, and 50 kilometers in the direction of the nearby federal Class I areas. Similarly, a set of flagpole heights was applied at each receptor to account for elevations at the Class I areas. The modeled concentrations at the receptors along the multiple arcs were used to establish formulae for estimating concentration at a Class I area as a function of the Class I area's distance from Shell Polymers Monaca Site. Shell provided a detailed description of the receptors and formulae used in the Class I Area SIL analyses in subsection 8.2 (Class I Significant Impacts Analysis) of Appendix D-1 of the plan approval application.

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<sup>41</sup> *Code of Federal Regulations*. 40 CFR § 50.1(e). Definition of "ambient air."

<sup>42</sup> Revised Policy on Exclusions from "Ambient Air." EPA memorandum from Andrew R. Wheeler, Administrator to Regional Administrators. December 2, 2019.

<sup>43</sup> *Code of Federal Regulations*. 40 CFR Part 51, Appendix W (Guideline on Air Quality Models). Subsection 4.2.c.

## b. Terrain Preprocessing

In all the analyses, receptor elevations and hill height scales were calculated by the AERMOD terrain preprocessor (AERMAP) v24142 utilizing the USGS 3-Dimensional Elevation Program (3DEP) data with a one-third arc-second resolution.

## 4. Meteorology Pathway

Shell's air dispersion modeling utilized a 5-year meteorological dataset consisting of hourly records from January 1, 2018, through December 31, 2022, derived from primary surface data from the Beaver Valley Nuclear Generating Station (Beaver Valley) and secondary surface data and upper air data from Pittsburgh International Airport (KPIT).

### a. Meteorological Dataset Preprocessing

The meteorological dataset was processed by the DEP with the AERMOD meteorological preprocessor (AERMET) v24142 and its associated AERSURFACE v24142 tool.

The Beaver Valley and KPIT data provide the minimum meteorological measurements necessary for AERMET to produce the two output files, i.e., the surface and profile files, necessary for AERMOD input. The Beaver Valley surface data included wind speed and wind direction measurements at three levels, i.e., 10.7, 45.7, and 152.4 meters, and temperature measurements at 10.7 meters. Other surface parameters, i.e., station pressure, cloud cover, and relative humidity, were obtained from the KPIT surface data. The KPIT upper air data included multi-level morning measurements of atmospheric pressure, dry bulb temperature, dew point temperature, wind direction, and wind speed from the surface to the first level above 5,000 meters.

AERMET Stage 1 read the Beaver Valley surface data, which was obtained from the Beaver Valley Nuclear Generating Station,<sup>44</sup> the KPIT surface data, which was downloaded from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) in the Integrated Surface Data (ISD) format, and the KPIT upper air data, which was downloaded from NCEI in the Integrated Global Radiosonde Archive (IGRA) format. Before processing with AERMET Stage 1, a Line 21 with missing data codes was added to the KPIT upper air 12Z measurements with a missing Line 11 or 21. This allowed AERMET to process all available upper air 12Z measurements. Additionally, AERMET Stage 1 utilized the MODIFY option to check for and correct problems with the upper air data and utilized a minimum wind speed threshold of 0.3 meter per second for the Beaver Valley surface data.

AERMET Stage 2 utilized the surface friction velocity adjustment option, which is intended to address potential concerns regarding AERMOD's performance (i.e., overprediction of

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<sup>44</sup> Surface meteorological data from the Beaver Valley Nuclear Generating Station was shared by a representative of the power station on August 15, 2023.

concentration) during stable low wind speed meteorological conditions by adjusting the surface friction velocity based on Qian, W., and A. Venkatram, 2011.<sup>45</sup>

AERMET Stage 2 utilized options for substitutions of missing temperature and cloud cover measurements and a 3-hour before to 1-hour after 12Z window for determining upper air measurements for use.

AERMET Stage 2 utilized output data from AERSURFACE, which processed annual NLCD v1.0 land cover and fractional impervious surface data for 2018, 2019, 2020, and 2021 along with tree canopy cover data for the same years, downloaded from the USGS MRLC, to estimate noontime albedo, daytime Bowen ratio, and surface roughness length ( $z_0$ ) for the Beaver Valley meteorological site. AERSURFACE utilized options for a default 1-kilometer  $z_0$  study area with ten user-defined sectors with low  $z_0$  and high  $z_0$  designations, non-arid condition, and monthly frequency with month-to-season assignments as follows: winter (December, January, and February), spring (March, April, and May), summer (June, July, and August), and autumn (September, October, and November). Surface moisture condition (wet, dry, or average) for the Beaver Valley meteorological station was determined by comparing the monthly precipitation data for Pennsylvania Climate Division 09, downloaded from NCEI, with surface moisture conditions thresholds derived from a 30-year (1991-2020) climatological dataset in accordance with the EPA's guidance.<sup>46</sup> Snow cover condition (non-continuous or continuous) was based on observational data for KPIT, downloaded from NCEI.

#### b. Meteorological Dataset Representativeness

The fully processed meteorological dataset satisfies the EPA's recommendations for use in AERMOD,<sup>47</sup> and was appropriate for AERMOD to construct realistic boundary layer profiles to adequately represent plume transport and dispersion under both convective and stable conditions within the modeling domain. Additionally, the fully processed meteorological dataset satisfies the DEP's data completeness recommendation for use in air dispersion modeling.

The Beaver Valley meteorological station is located approximately 8 kilometers downstream of Shell Polymers Monaca Site. The Beaver Valley meteorological station has topography and orientation, relative to the Ohio River, similar to those of Shell Polymers Monaca Site. As recommended by the EPA's guidance,<sup>48</sup> the estimated values of the surface characteristics, i.e., noontime albedo, daytime Bowen ratio, and  $z_0$ , for the Beaver Valley meteorological station were compared to those of Shell Polymers Monaca Site. As illustrated in Figure 9 (Albedo and Bowen Ratio Comparison Results) and Figure 10 (Surface Roughness Comparison Results) of Appendix D-1 of the plan approval application, both sites have similar surface characteristics.

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<sup>45</sup> Qian, W., and A. Venkatram, 2011. Performance of Steady-State Dispersion Models Under Low Wind-Speed Conditions. *Boundary Layer Meteorology*, 138, 475-491.

<sup>46</sup> User's Guide for AERSURFACE Tool (EPA-454/B-24-003, November 2024). Subsection 2.3.3.

<sup>47</sup> *Code of Federal Regulations*. 40 CFR Part 51, Appendix W (Guideline on Air Quality Models). Subsections 8.4.3.2 and A.1(b)(2).

<sup>48</sup> AERMOD Implementation Guide (EPA-454/B-24-009, November 2024). Subsection 3.1.1.

The KPIT meteorological site, which is located approximately 21 kilometers southeast of Shell Polymers Monaca Site, is the nearest surface site with Automated Surface Observing System (ASOS) instrumentation and the nearest upper air site.

Shell provided a detailed discussion on the representativeness of the Beaver Valley surface data and the KPIT surface data and upper air data in subsection 4.5 (Meteorological Data) of Appendix D-1 of the plan approval application.

## 5. Output Pathway

In each analysis, AERMOD’s output pathway includes options to calculate and format the appropriate design concentrations at the model receptors.

### C. Secondary PM-2.5 Formation

In the Class II Area and Class I Area SIL analyses for PM-2.5 for the EMACT Project, Shell estimated the secondary PM-2.5 formation due to Shell’s net emissions increase of PM-2.5 precursors, i.e., NO<sub>x</sub> and SO<sub>2</sub> and adjusted the AERMOD results accordingly based on the EPA’s guidance.<sup>49,50,51</sup> Shell’s estimated secondary PM-2.5 impacts from the EMACT Project in both Class II areas and Class I areas were based on the EPA’s most conservative photochemical grid modeling results for hypothetical sources in the Northeast and Ohio Valley climate zones with 500 tons per year of emissions of either precursor. Shell’s estimated secondary PM-2.5 impacts for Class II areas and Class I areas are summarized in Tables 3a and 3b, respectively.

Table 3a: Estimated Secondary PM-2.5 Impacts at Class II Areas from Shell’s EMACT Project

Averaging Time	Secondary PM-2.5 Impact Due to NO <sub>x</sub>	Secondary PM-2.5 Impact Due to SO <sub>2</sub>	Total Secondary PM-2.5 Impact
	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>
24-hour	0.04100	0.00504	0.04604
Annual	0.00177	0.00008	0.00185

Table 3b: Estimated Secondary PM-2.5 Impacts at Class I Areas from Shell’s EMACT Project

Averaging Time	Secondary PM-2.5 Impact Due to NO <sub>x</sub>	Secondary PM-2.5 Impact Due to SO <sub>2</sub>	Total Secondary PM-2.5 Impact
	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>
24-hour	0.00663	0.00030	0.00693
Annual	0.00019	0.0000480	0.00019

Shell described the procedure it followed to account for secondary PM-2.5 formation and presented the estimated secondary PM-2.5 impacts in subsection 5.6 (Secondary PM-2.5

<sup>49</sup> Guidance for Ozone and Fine Particulate Matter Permit Modeling (EPA-454/R-22-005, July 2022).

<sup>50</sup> Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM<sub>2.5</sub> under the PSD Permitting Program (EPA-454/R-19-003, April 2019).

<sup>51</sup> Clarification on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM<sub>2.5</sub> under the PSD Permitting Program. EPA memorandum from Tyler Fox, OAQPS to Regional Office Modeling Contacts. April 30, 2024.

Analyses) and subsection 6.3 (Secondary PM-2.5 Analysis Results) of Appendix D-1 of the plan approval application.

#### D. Existing Ambient Air Quality and Monitored Component of Background Concentrations

Existing ambient air quality was characterized for the area near Shell Polymers Monaca Site by utilizing representative CO, NO<sub>x</sub>, PM-10, and PM-2.5 data measured at the DEP-operated or Allegheny County Health Department (ACHD)-operated ambient monitors listed in Table 4.

Table 4: Monitors for Establishing Existing Ambient Air Quality Near Shell Polymers Monaca Site

Pollutant	Monitor Site Name	Monitor Site ID	Distance/Direction from Shell Polymers Monaca Site
CO	Lawrenceville <sup>[a]</sup>	42-003-0008	39 km / Southeast
NO <sub>2</sub>	Beaver Falls	42-007-0014	9 km / North
PM-10	Beaver Falls	42-007-0014	9 km / North
PM-2.5	Beaver Falls / Fort McIntosh <sup>[b]</sup>	42-007-0014 /	9 km / North (Beaver Falls)
		42-007-0008	4 km / Northeast (Fort McIntosh)

<sup>[a]</sup> Operated by ACHD.

<sup>[b]</sup> The DEP added this monitor in its technical review due to its proximity to Shell Polymers Monaca Site.

Shell provided a discussion on monitor availability and selection in subsection 4.3 (Source and Monitoring Data) of Appendix D-1 of the plan approval application

Shell utilized monitored concentrations for January 1, 2020, through December 31, 2022, to characterize existing air quality near Shell Polymers Monaca Site and, if necessary, to characterize the monitored component of the background concentration in a cumulative impact analysis for the NAAQS. In its technical review, the DEP updated the monitoring concentrations to reflect the most recent period of certified data, January 1, 2022, through December 31, 2024. The CO, NO<sub>2</sub>, PM-10, and PM-2.5 monitored concentrations are listed in Table 5.

Table 5: Monitored Concentrations for Establishing Existing Ambient Air Quality Near Shell Polymers Monaca Site

Pollutant	Monitor Site Name	Averaging Time	Monitored Concentration <sup>[a]</sup>	
			(µg/m <sup>3</sup> )	
			2020-2022 <sup>[b]</sup>	2022-2024 <sup>[c]</sup>
CO	Lawrenceville	1-hour	2,648	2,691
		8-hour	1,602	2,197
NO <sub>2</sub>	Beaver Falls	1-hour <sup>[d]</sup>	37.1	36.6
		Annual	16.1	16.1
PM-10	Beaver Falls	24-hour	66.0	62.8 <sup>[e]</sup>
PM-2.5	Beaver Falls	24-hour	21.9	20.7
		Annual	8.6	8.4
	Fort McIntosh <sup>[f]</sup>	24-hour	-	19.6
		Annual <sup>[g]</sup>	-	7.6

<sup>[a]</sup> Values for 1-hour CO, 8-hour CO, annual NO<sub>2</sub>, and 24-hour PM-10 are the maximum monitored concentrations while values for 1-hour NO<sub>2</sub>, 24-hour PM-2.5, and annual PM-2.5 are the design values.

<sup>[b]</sup> Data period for monitored concentrations used by Shell in its NAAQS analyses. Corresponding values are summarized in Table 1 (Existing Air Quality and Background Concentrations) of Appendix D-1 of the plan approval application.

<sup>[c]</sup> Most recent 3-year period with certified data used by the DEP in its technical review.

<sup>[d]</sup> For the 1-hour NO<sub>2</sub> NAAQS analysis, Shell used temporally-varying concentrations instead of the design value.

<sup>[e]</sup> Third-highest 24-hour value over the three-year period based on assessment of impacts due to wildfire smoke.

<sup>[f]</sup> The Fort McIntosh monitor site, which is the closest PM-2.5 monitor site to Shell Polymers Monaca Site, was not considered by Shell because Shell's period for monitoring data was from January 1, 2020, through December 31, 2022, whereas the Fort McIntosh monitor site started its operation only on May 4, 2022.

<sup>[g]</sup> The annual design value was based on ~2.5 years (10 quarters) rather than 3 years (12 quarters).

For the 1-hour NO<sub>2</sub> NAAQS analysis for the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations, Shell used temporally-varying NO<sub>2</sub> concentrations, calculated as 98<sup>th</sup>-percentile values that vary by season and hour-of-day. These temporally-varying NO<sub>2</sub> concentrations were entered as an input to AERMOD; therefore, concentrations modeled by AERMOD already accounted for the monitored component of the background concentrations. The temporally-varying monitored background concentrations used by Shell are summarized in Table 2 (Beaver Falls 98% Hourly NO<sub>2</sub> (ppb) By Season and Hour of Day) of Appendix D-1 of the plan approval application whereas the temporally-varying monitoring background concentrations used by the DEP are summarized in Table 7.

Table 7: Temporally-Varying NO<sub>2</sub> Concentrations Calculated as 98th-Percentile Values and Vary by Season and Hour-of-Day, for 2022-2024

Model Ending Hour	NO <sub>2</sub> Concentrations			
	(ppb)			
	Winter	Spring	Summer	Fall
01 <sup>[a]</sup>	31.2	25.0	19.2	23.4
02 <sup>[b]</sup>	32.1	25.1	19.2	23.2
03	33.0	28.5	23.4	24.1
04	32.4	29.6	20.9	24.0
05	32.8	27.9	20.0	26.0
06	33.5	28.7	19.3	25.1
07	33.2	30.9	18.3	24.8
08	33.4	30.7	16.8	25.6
09	33.8	31.2	15.3	26.1
10	32.7	30.8	13.9	26.8
11	32.7	24.2	9.3	23.7
12	31.5	14.3	5.6	19.6
13	25.9	9.6	6.1	14.4
14	25.2	8.9	4.7	14.5
15	21.2	9.5	4.5	14.8
16	24.7	6.2	4.7	14.2
17	28.0	6.8	5.1	15.4
18	29.5	9.0	6.3	21.3
19	31.0	15.5	8.6	22.3
20	30.8	18.0	13.5	24.4

Model Ending Hour	NO <sub>2</sub> Concentrations			
	(ppb)			
	Winter	Spring	Summer	Fall
21	31.9	20.5	14.2	25.1
22	31.4	22.3	15.5	26.9
23	31.5	26.1	17.6	25.0
24	30.7	25.4	19.3	25.0

<sup>[a]</sup> Starting July 2023, concentrations for Hour 01 (hour ending) were not measured. The substitute data was interpolated from the preceding (Hour 24) and succeeding (Hour 03) hours with measured concentrations.

<sup>[b]</sup> Concentrations are not measured during Hour 02 (hour ending) due to scheduled daily calibration. The substitute data was the average of the preceding (Hour 01) and succeeding (Hour 03) hours with measured or calculated concentrations.

Additionally, Shell is exempted from the PSD pre-application ambient monitoring requirements<sup>52</sup> for PM since the EPA has not established a significant monitoring concentration (SMC) for this pollutant.<sup>53</sup> Shell's emissions of H<sub>2</sub>SO<sub>4</sub> are not subject to the PSD pre-application ambient monitoring requirements since the net emissions increase due to the EMAXT Project and the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations are both less than the PSD SER.

## F. Modeling Results

### 1. Operating Scenario Analyses

The combustion turbine load analysis determined that the 100% load condition would result in worst-case impacts for all averaging periods, i.e., 1-hour, 8-hour, 24-hour, and annual. The ethane cracking furnace mode analysis determined that the operation modes resulting in worst-case impacts would be decoking for 1-hour CO and 8-hour CO analyses, and normal operation with maximum emission rate for 1-hour NO<sub>2</sub>, annual NO<sub>2</sub>, 24-hour PM-10, and annual PM-10 analyses. The worst-case ethane cracking furnace analysis determined that Ethane Cracking Furnace #1 and Ethane Cracking Furnace #2 generated the worst-case impacts for 1-hour and 8-hour averaging periods. Shell presented the results of the operating scenario analyses and discussed how the results were applied in the air quality analyses in subsections 6.2 (Combustion Turbine Load Analysis Results) and 6.3 (Ethane Cracking Furnace Mode and Worst-Case Operating Condition Results) of Appendix D-1 of the plan approval application.

### 2. SIL Analyses

#### a. SIL Analyses for NAAQS and Class II Area PSD Increments

The impacts of Shell's net emissions increase due to the EMAXT Project were calculated by AERMOD at all receptors to be less than the following:

<sup>52</sup> *Code of Federal Regulations*. 40 CFR § 52.21(m)(1)(i).

<sup>53</sup> *Code of Federal Regulations*. 40 CFR § 52.21(i)(5).

- The EPA’s 1-hour CO and 8-hour CO SILs for the NAAQS;<sup>54</sup>
- The EPA’s 1-hour NO<sub>2</sub> interim SIL for the NAAQS;<sup>55,56</sup>
- The EPA’s annual NO<sub>2</sub> SIL for the NAAQS;<sup>57</sup>
- The EPA’s 24-hour PM-2.5 and annual PM-2.5 SILs for the NAAQS;<sup>58,59,60,61</sup>
- The EPA’s annual NO<sub>2</sub> SIL for the Class II Area PSD increments;<sup>62</sup> and
- The EPA’s 24-hour PM-2.5 and annual PM-2.5 SILs for the Class II Area PSD increments.<sup>63,64,65,66</sup>

Therefore, for the EMACT Project, no cumulative impact analyses are necessary for the 1-hour CO, 8-hour CO, 1-hour NO<sub>2</sub>, annual NO<sub>2</sub>, 24-hour PM-2.5, and annual PM-2.5 NAAQS and annual NO<sub>2</sub>, 24-hour PM-2.5, and annual PM-2.5 Class II Area PSD increments. The results of the SIL analyses for the NAAQS and Class II Area PSD increments for the EMACT Project are summarized in Table 8a.

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<sup>54</sup> *Code of Federal Regulations*. 40 CFR § 51.165(b)(2).

<sup>55</sup> Guidance Concerning the Implementation of the 1-hour NO<sub>2</sub> NAAQS for the Prevention of Significant Deterioration Program. EPA memorandum from Stephen D. Page, OAQPS to Regional Air Division Directors. June 29, 2010. Pages 11-13.

<sup>56</sup> Interim 1-Hour Significant Impact Levels for Nitrogen Dioxide and Sulfur Dioxide. DEP memorandum from Andrew W. Fleck, BAQ/Air Quality Modeling to Regional Air Program Managers. December 1, 2010.

<sup>57</sup> *Code of Federal Regulations*. 40 CFR § 51.165(b)(2).

<sup>58</sup> Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program. EPA memorandum from Peter Tsirigotis, OAQPS to Regional Air Division Directors. April 17, 2018. Pages 15-16.

<sup>59</sup> Technical Basis for the EPA’s Development of the Significant Impact Thresholds for PM<sub>2.5</sub> and Ozone (EPA-454/R-18-001, April 2018).

<sup>60</sup> Legal Memorandum: Application of Significant Impact Levels in the Air Quality Demonstration for Prevention of Significant Deterioration Permitting under the Clean Air Act. April 2018.

<sup>61</sup> Supplement to the Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program. EPA memorandum from Richard Wayland and Scott Mathias, OAQPS to Regional Air Division Directors. April 30, 2024. Pages 6-7.

<sup>62</sup> *Code of Federal Regulations*. 40 CFR § 51.165(b)(2). Based on long-standing EPA policy and guidance, these NAAQS SILs have also been applied to Class II PSD increments.

<sup>63</sup> Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program. EPA memorandum from Peter Tsirigotis, OAQPS to Regional Air Division Directors. April 17, 2018. Pages 16-17.

<sup>64</sup> Technical Basis for the EPA’s Development of the Significant Impact Thresholds for PM<sub>2.5</sub> and Ozone (EPA-454/R-18-001, April 2018).

<sup>65</sup> Legal Memorandum: Application of Significant Impact Levels in the Air Quality Demonstration for Prevention of Significant Deterioration Permitting under the Clean Air Act. April 2018.

<sup>66</sup> Supplement to the Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program. EPA memorandum from Richard Wayland and Scott Mathias, OAQPS to Regional Air Division Directors. April 30, 2024. Pages 7-8.

Table 8a: Results of SIL Analyses for NAAQS and Class II Area PSD Increments for the EMACT Project

Pollutant	Averaging Time	Modeled Concentration <sup>[a]</sup>	SIL for NAAQS & Class II Area PSD Increment
		$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
CO	1-hour	8.37474 <sup>[b]</sup> / 8.37474	2,000
	8-hour	2.66319 / 2.66319	500
NO <sub>2</sub>	1-hour	0.96266 / 0.96266	7.5
	Annual	0.00446 / 0.00446	1.0
PM-2.5 <sup>[c],[d]</sup>	24-hour	0.06786 / 0.06831	1.2
	Annual	0.00239 / 0.00239	0.13

<sup>[a]</sup> Two values are presented. The first value is from Shell's run while the second value is from the DEP's confirmation run.

<sup>[b]</sup> A value of 8.36  $\mu\text{g}/\text{m}^3$  was documented by Shell in Table 14 (EMACT Project Class II Significant Impact Analysis Results) of Appendix D-1 of the plan approval application. Based on the model output files provided by Shell, the modeled maximum concentration was 8.37  $\mu\text{g}/\text{m}^3$ .

<sup>[c]</sup> To avoid separate PM-2.5 SIL analyses, Shell opted to use the maximum concentration over all five years, which is the value used to assess significance in the PM-2.5 SIL analyses for Class II Area PSD increments, in assessing significance in the PM-2.5 SIL analyses for the NAAQS.

<sup>[d]</sup> AERMOD results were adjusted upward to account for secondary PM-2.5 formation. See Table 3a.

For the revised PSD air quality analyses, the impacts of Shell's revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations were calculated by AERMOD to be greater than the following:

- The EPA's 1-hour CO and 8-hour CO SILs for the NAAQS;<sup>67</sup>
- The EPA's 1-hour NO<sub>2</sub> interim SIL for the NAAQS;<sup>68,69</sup>
- The EPA's annual NO<sub>2</sub> SIL for the NAAQS;<sup>70</sup>
- The EPA's 24-hour PM-10 SIL for the NAAQS;<sup>71</sup>
- The EPA's annual NO<sub>2</sub> SIL for the Class II Area PSD increments;<sup>72</sup> and
- The EPA's 24-hour PM-10 and annual PM-10 SILs for the Class II Area PSD increments.<sup>73</sup>

Cumulative impact analyses were therefore necessary for the 1-hour CO, 8-hour CO, 1-hour NO<sub>2</sub>, annual NO<sub>2</sub>, and 24-hour PM-10 NAAQS, as well as the annual NO<sub>2</sub>, 24-hour PM-10, and annual PM-10 Class II Area PSD increments. The results of the SIL analyses for the NAAQS

<sup>67</sup> *Code of Federal Regulations*. 40 CFR § 51.165(b)(2).

<sup>68</sup> Guidance Concerning the Implementation of the 1-hour NO<sub>2</sub> NAAQS for the Prevention of Significant Deterioration Program. EPA memorandum from Stephen D. Page, OAQPS to Regional Air Division Directors. June 29, 2010. Pages 11-13.

<sup>69</sup> Interim 1-Hour Significant Impact Levels for Nitrogen Dioxide and Sulfur Dioxide. DEP memorandum from Andrew W. Fleck, BAQ/Air Quality Modeling to Regional Air Program Managers. December 1, 2010.

<sup>70</sup> *Code of Federal Regulations*. 40 CFR § 51.165(b)(2).

<sup>71</sup> *Ibid*.

<sup>72</sup> *Code of Federal Regulations*. 40 CFR § 51.165(b)(2). Based on long-standing EPA policy and guidance, these NAAQS SILs have also been applied to Class II PSD increments.

<sup>73</sup> *Ibid*.

and Class II Area PSD increments for the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations are summarized in Table 8b.

Table 8b: Results of SIL Analyses for NAAQS and Class II Area PSD Increments for Revised PTE that Accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations

Pollutant	Averaging Time	Modeled Concentration <sup>[a]</sup>	SIL for NAAQS & Class II Area PSD Increment
		$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
CO	1-hour	3,329.95127 / 3,329.95127	2,000
	8-hour	1,192.93122 / 1,192.94337	500
NO <sub>2</sub>	1-hour	115.59300 / 115.59315	7.5
	Annual	3.27264 / 3.27303	1.0
PM-10	24-hour	21.80379 / 21.80363	1.2
	Annual	2.22056 / 2.22056	0.13

<sup>[a]</sup> Two values are presented. The first value is from Shell's run while the second value is from the DEP's confirmation run.

Shell provided a detailed description of the SIL analyses for the NAAQS and Class II Area PSD increments in subsections 5.4 (Significant Impact Analysis), 6.4 (EMACT Project Significant Impact Analysis Results), and 6.5 (Plan Approval Reconciliations and WWTP Permanent Controls Project Significant Impact Analysis Results) of Appendix D-1 of the plan approval application.

**b. SIL Analyses for Class I Area PSD Increments**

The impacts of Shell's net emissions increase due to the EMACT Project were calculated by AERMOD to be less than the following:

- The EPA's annual NO<sub>2</sub> proposed SIL for the Class I Area PSD increment,<sup>74</sup> and
- The EPA's 24-hour PM-2.5 and annual PM-2.5 SILs for the Class I Area PSD increments.<sup>75,76,77,78</sup>

<sup>74</sup> *Federal Register*. 61 FR 38250. Prevention of Significant Deterioration and Nonattainment New Source Review; Proposed Rule. July 23, 1996.

<sup>75</sup> Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program. EPA memorandum from Peter Tsigotis, OAQPS to Regional Air Division Directors. April 17, 2018. Pages 16-17.

<sup>76</sup> Technical Basis for the EPA's Development of the Significant Impact Thresholds for PM<sub>2.5</sub> and Ozone (EPA-454/R-18-001, April 2018).

<sup>77</sup> Legal Memorandum: Application of Significant Impact Levels in the Air Quality Demonstration for Prevention of Significant Deterioration Permitting under the Clean Air Act. April 2018.

<sup>78</sup> Supplement to the Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program. EPA memorandum from Richard Wayland and Scott Mathias, OAQPS to Regional Air Division Directors. April 30, 2024. Pages 7-8.

Therefore, for the EMACT Project, no cumulative impact analyses were necessary for the annual NO<sub>2</sub>, 24-hour PM-2.5, and annual PM-2.5 Class I Area PSD increments. The results of the SIL analyses for the Class I Area PSD increments for the EMACT Project are summarized in Table 9a.

Table 9a: Results of SIL Analyses for Class I Area PSD Increments for the EMACT Project

Pollutant	Averaging Time	Modeled Concentration <sup>[a]</sup>	SIL for Class I Area PSD Increment
		µg/m <sup>3</sup>	µg/m <sup>3</sup>
NO <sub>2</sub>	Annual	0.00410 / 0.00410	0.1
PM-2.5 <sup>[b]</sup>	24-hour	0.05371 <sup>[c]</sup> / 0.05374	0.27
	Annual	0.00070 / 0.00069	0.03

<sup>[a]</sup> Two values are presented. The first value is from Shell's run while the second value is from the DEP's confirmation run.

<sup>[b]</sup> AERMOD results were adjusted upward to account for secondary PM-2.5 formation. See Table 3b.

<sup>[c]</sup> This is the maximum 24-hour value among the 5 years simulated as confirmed by the DEP using the model output files provided by Shell. The value (0.020 µg/m<sup>3</sup>) documented by Shell in Table 23 of Appendix D-1 of the plan approval application was obtained by averaging the maximum 24-hour values among the 5 years and then getting the maximum 5-year average 24-hour value; however, averaging is not allowed in SIL increment analyses.

For the revised PSD air quality analyses, the impacts of Shell's revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations were calculated by AERMOD, and with subsequent calculations for the 24-hour PM-10 analysis, to be less than the following:

- The EPA's annual NO<sub>2</sub> proposed SIL for the Class I Area PSD increment;<sup>79</sup> and
- The EPA's 24-hour and annual PM-10 proposed SIL for the Class I Area PSD increments.<sup>80</sup>

Therefore, no cumulative impact analyses were necessary for the annual NO<sub>2</sub>, 24-hour PM-10, and annual PM-10 Class I Area PSD increments. The results of the SIL analyses for the Class I Area PSD increments for the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations, are summarized in Table 9b.

Table 9b: Results of SIL Analyses for Class I Area PSD Increments for Revised PTE that Accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations

Pollutant	Averaging Time	Modeled Concentration <sup>[a]</sup>	SIL for NAAQS & Class I Area PSD Increment
		µg/m <sup>3</sup>	µg/m <sup>3</sup>
NO <sub>2</sub>	Annual	0.02568 / 0.02568	0.1
PM-10	24-hour <sup>[b]</sup>	0.00482 <sup>[c]</sup> / 0.00480 <sup>[d]</sup>	0.3
	Annual	0.01536 / 0.01536	0.2

<sup>79</sup> *Federal Register*. 61 FR 38250. Prevention of Significant Deterioration and Nonattainment New Source Review; Proposed Rule. July 23, 1996.

<sup>80</sup> *Ibid*.

<sup>[a]</sup> Two values are presented. The first value is from Shell’s run while the second value is from the DEP’s confirmation run.

<sup>[b]</sup> This is the value calculated by AERMOD when using the additional receptors at distances of 10, 20, 30, 40, and 50 kilometers.

<sup>[c]</sup> Shell’s formulae, one for each flagpole height category, were derived using impacts modeled using elevations for three of the four Class I areas, i.e., Dolly Sods Wilderness, Otter Creek Wilderness, and Shenandoah National Park.

<sup>[d]</sup> In the DEP’s confirmation, impacts used in deriving the formulae were based on elevations for all four Class I areas, which now included James River Face Wilderness. Inclusion of James River Face Wilderness resulted in different formulae for both the average and maximum elevation categories but same formula for the minimum elevation category.

Shell provided a detailed description of the SIL analyses for the Class I Area PSD increments in subsection 8.2 (Class I Significant Impacts Analysis) of Appendix D-1 of the plan approval application.

### 3. NAAQS Analyses

As stated previously, no cumulative impact analyses for the 1-hour CO, 8-hour CO, 1-hour NO<sub>2</sub>, annual NO<sub>2</sub>, 24-hour PM-2.5, and annual PM-2.5 NAAQS were necessary for the net emissions increase associated with the EMACT Project, but cumulative impact analyses for the 1-hour CO, 8-hour CO, 1-hour NO<sub>2</sub>, annual NO<sub>2</sub>, and 24-hour PM-10 NAAQS were necessary for the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations. Shell’s cumulative impact analyses for the revised PTE also accounted for the net emissions increase due to the EMACT Project. The impacts of the revised PTE, in conjunction with net emissions increase due to the EMACT Project and emissions that represent existing nearby sources, were calculated by AERMOD to be less than the 1-hour CO, 8-hour CO, 1-hour NO<sub>2</sub>, annual NO<sub>2</sub>, and 24-hour PM-10 NAAQS. The results of Shell’s NAAQS analyses are summarized in Table 10.

Table 10: Results of NAAQS Analyses for Revised PTE that Accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations<sup>[a]</sup>

Pollutant	Averaging Time	Modeled Concentration	Monitored Background Concentration 2020-2022 / 2022-2024	Design Concentration	NAAQS <sup>[b]</sup>
		µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>
CO	1-hour <sup>[c]</sup>	3,104.20394 / 3,104.20394	2,648 / 2,691	5,752.20394 / 5,795.20394	40,000
	8-hour <sup>[d]</sup>	880.68695 / 880.69097	1,602 / 2,197	2,482.68695 / 3,077.69097	10,000
NO <sub>2</sub>	1-hour <sup>[e]</sup>	178.46580 / 177.95590	n/a <sup>[i]</sup>	178.46580 / 177.95590	188
	Annual <sup>[f]</sup>	4.79643 / 4.79586	16.1 / 16.1	20.89643 / 20.92626	100
PM-10	24-hour	20.52266 <sup>[g]</sup> / 20.05395 <sup>[h]</sup>	66.0 / 2.8	86.52266 / 82.80395	150

<sup>[a]</sup> Two values are presented for columns ‘Modeled Maximum Design Concentration’, ‘Monitored Background Concentration’, and ‘Total Concentration’. The first values are from Shell’s runs while the second values are from the DEP’s confirmation runs.

<sup>[b]</sup> These are primary NAAQS. Among the pollutants and averaging times in this table, those with secondary NAAQS are annual NO<sub>2</sub> and 24-hour PM-10. Their secondary NAAQS are equal to their primary NAAQS.

<sup>[c]</sup> Design concentration is the maximum highest, 2<sup>nd</sup>-highest 1-hour concentration among the years of the 5-year meteorological dataset.

<sup>[d]</sup> Design concentration is the maximum highest, 2<sup>nd</sup>-highest 8-hour concentration among the years of the 5-year meteorological dataset.

<sup>[e]</sup> Design concentration is the maximum 5-year average of the 98<sup>th</sup> percentile (i.e., highest 8<sup>th</sup>-highest) of the maximum daily 1-hour concentration.

<sup>[f]</sup> Design concentration is the maximum annual concentration among the years of the 5-year meteorological dataset.

<sup>[g]</sup> In Shell’s model run for 24-hour PM-10, design concentration is the maximum highest, 2<sup>nd</sup>-highest 24-hour concentration among the years of the 5-year meteorological dataset.

<sup>[h]</sup> In the DEP’s confirmation run for 24-hour PM-10, design concentration is the highest, 6<sup>th</sup>-highest 24-hour concentration over the 5-year meteorological dataset

<sup>[i]</sup> Background 1-hour NO<sub>2</sub> concentrations were entered as an input to AERMOD.

Shell provided a detailed description of the NAAQS analyses in subsections 5.8 (NAAQS Analysis and Increment Analyses) and 6.6 (NAAQS Analysis Results) of Appendix D-1 of the plan approval application.

Cumulative impact analyses for the 24-hour PM-2.5 and annual PM-2.5 NAAQS were not necessary for the net emissions increase associated with the EMACT Project because its impact did not exceed PM-2.5 SILs. Also, the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations was not subject to the PSD regulations for PM-2.5. Based on an additional analysis on PM-2.5, Table 11 below shows that the sum of (1) the PM-2.5 impacts of the net emissions increase due to the EMACT Project, i.e., the results of the 24-hour PM-2.5 and annual PM-2.5 SIL analyses for the NAAQS, plus (2) a 2022-2024 PM-2.5 concentration from the nearby Fort McIntosh ambient monitor concentration is below the NAAQS.

Table 11: Comparison of Modeled Maximum Concentration for the EMACT Project Plus 2022-2024 Monitored Concentration to NAAQS<sup>[a]</sup>

Pollutant	Averaging Time	Modeled Concentration	Monitored Concentration 2022-2024	Design Concentration	NAAQS	Percent of NAAQS
		µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	%
PM-2.5 <sup>[b],[c]</sup>	24-hour	0.06831	19.6	19.66831	35 <sup>[d]</sup>	56.20
	Annual	0.00239	7.6	7.60239	9.0 <sup>[e]</sup> 15.0 <sup>[f]</sup>	84.47 50.68

<sup>[a]</sup> Modeled maximum concentrations were based on the DEP’s technical review.

<sup>[b]</sup> AERMOD results were adjusted upward to account for secondary PM-2.5 formation. See Table 4a.

<sup>[c]</sup> PM-2.5 concentration data from Fort McIntosh monitor site.

<sup>[d]</sup> The 24-hour PM-2.5 secondary NAAQS is equal to the 24-hour PM-2.5 primary NAAQS.

<sup>[e]</sup> Annual PM-2.5 primary NAAQS.

<sup>[f]</sup> Annual PM-2.5 secondary NAAQS.

#### 4. PSD Increment Analyses

As previously stated, no cumulative impact analyses for the annual NO<sub>2</sub>, 24-hour PM-2.5, and annual PM-2.5 Class II Area PSD increments were necessary for the net emissions increase associated with the EMACT Project, but cumulative impact analyses for the annual NO<sub>2</sub>, 24-hour PM-10, and annual PM-10 Class II Area PSD increments were necessary for the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations. Shell’s cumulative impact analyses for the revised PTE also accounted for the net emissions increase due to the EMACT Project. The impacts of Shell’s revised PTE, in conjunction with net emissions increase due to the EMACT Project and emissions that represent potential increment-consuming sources, were calculated by AERMOD to be less than the annual NO<sub>2</sub>, 24-hour PM-10, and annual PM-10 Class II Area PSD increments. The results of the Class II Area PSD increment analyses are summarized in Table 12.

Table 12: Results of Class II Area PSD Increment Analyses for Revised PTE that Accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations<sup>[a]</sup>

Pollutant	Averaging Time	Modeled Design Concentration	Class II Area PSD Increment
		µg/m <sup>3</sup>	µg/m <sup>3</sup>
NO <sub>2</sub>	Annual <sup>[b]</sup>	5.38215 / 5.38148	25
PM-10	24-hour <sup>[c]</sup>	20.52266 / 20.52265	30
	Annual <sup>[b]</sup>	3.48846 / 3.48833	17

<sup>[a]</sup> Two values are presented. The first value is from Shell’s run while the second value is from the DEP’s confirmation run.

<sup>[b]</sup> Design concentration is the maximum annual concentration among the years of the 5-year meteorological dataset.

<sup>[c]</sup> Design concentration is the maximum highest, 2<sup>nd</sup>-highest 24-hour concentration among the years of the 5-year meteorological dataset.

Shell provided a detailed description of the Class II Area PSD increment analyses in subsections 5.8 (NAAQS Analysis and Increment Analyses) and 6.7 (PSD Class II Increment Analysis Results) of Appendix D-1 of the plan approval application.

In accordance with 25 Pa. Code § 127.45(b)(4), the DEP’s notice of proposed plan approval issuance in the *Pennsylvania Bulletin* must include, for sources subject to the PSD regulations, “the degree of increment consumption expected to result from the operation of the source or facility.” To this end, the degree of Class II Area and Class I Area PSD increment consumption expected to result from Shell’s EMACT Project is provided in Tables 13a and 13b, respectively. For the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations, the degree of Class II Area and Class I Area PSD increment consumption is provided in Tables 14a and 14b, respectively. PSD increment consumption in the tables below are the highest values between Shell’s runs and the DEP’s confirmation runs.

Table 13a: Degree of Class II Area PSD Increment Consumption from Shell's EMACT Project

Pollutant	Averaging Time	Degree of Class II Area PSD Increment Consumption		Class II Area PSD Increment
		$\mu\text{g}/\text{m}^3$	Percent of Class II Area PSD Increment	$\mu\text{g}/\text{m}^3$
NO <sub>2</sub>	Annual	0.00446	0.02 %	25
PM-2.5	24-hour	0.06831	0.76 %	9
	Annual	0.00239	0.06 %	4

Table 13b: Degree of Class I Area PSD Increment Consumption from Shell's EMACT Project

Pollutant	Averaging Time	Degree of Class I Area PSD Increment Consumption		Class I Area PSD Increment
		$\mu\text{g}/\text{m}^3$	Percent of Class I Area PSD Increment	$\mu\text{g}/\text{m}^3$
NO <sub>2</sub>	Annual	0.00410	0.16 %	2.5
PM-2.5	24-hour	0.05374	2.69 %	2
	Annual	0.00070	0.07 %	1

Table 14a: Degree of Class II Area PSD Increment Consumption from Revised PTE that Accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations

Pollutant	Averaging Time	Degree of Class II Area PSD Increment Consumption		Class II Area PSD Increment
		$\mu\text{g}/\text{m}^3$	Percent of Class II Area PSD Increment	$\mu\text{g}/\text{m}^3$
NO <sub>2</sub>	Annual	5.38215	21.53 %	25
PM-10	24-hour	20.52266	68.41 %	30
	Annual	3.48846	20.52 %	17

Table 14b: Degree of Class I Area PSD Increment Consumption from Revised PTE that Accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations

Pollutant	Averaging Time	Degree of Class I Area PSD Increment Consumption		Class I Area PSD Increment
		$\mu\text{g}/\text{m}^3$	Percent of Class I Area PSD Increment	$\mu\text{g}/\text{m}^3$
NO <sub>2</sub>	Annual	0.02568	1.03 %	2.5
PM-10	24-hour	0.00482	0.06 %	8
	Annual	0.01536	0.38 %	4

## 5. Confirmation of Air Dispersion Modeling Results

The DEP confirmed the overall results of Shell's air dispersion modeling by executing AERMOD upon reviewing the appropriateness of all model input, i.e., model options, emission data, downwash data, terrain data, and meteorological data.

## IV. Additional Impact Analyses

### A. Associated Growth

Shell revised its previous associated growth analysis, which was submitted as part of its application for Plan Approval 04-00740C, to account for the EMACT Project, WWTP Permanent Controls Project, and Plan Approval Reconciliations. Similar to their previous findings, Shell did not identify any nearby industrial growth that can be attributed to the construction of Shell Polymers Monaca Site or to the latest projects. Based on latest information, Shell now determined that even though there was job growth there was also no residential and commercial growth associated with Shell Polymers Monaca Site's construction and the latest projects as supported by population decline in Beaver County since 2014 and a population projection study indicating that Beaver County and nine (9) surrounding counties are expected to experience population decline over the coming decades.<sup>81</sup> Therefore, no secondary emissions<sup>82</sup> were included in the revised additional impact analyses of the impairment to visibility, soils, and vegetation, and the cumulative NAAQS and PSD increment analyses.

Shell provided a detailed description of the associated growth analysis in section 1.0 (Potential Impacts due to Growth) of Appendix D-2 (Additional Impacts Analysis: Potential Growth Impacts and Impairment to Soils and Vegetation for Shell Polymers Monaca) of the plan approval application.

### B. Visibility Impairment

Similarly, Shell revised its previous visibility impairment analysis, which was submitted as part of its application for Plan Approval 04-00740C, to account for the net emissions increase due to the EMACT Project and the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations. In the revised analysis, Shell conducted two sets of visibility impairment analyses, one for the two totally enclosed ground flares and the elevated, steam-assisted flare and another for the rest of Shell's sources, based on significantly different plume heights between the three flares and the rest of the sources.<sup>83</sup> Using the Briggs plume rise equation,<sup>84</sup> plume heights calculated by Shell ranged from 6,169 to 6,237 meters for the two

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<sup>81</sup> The revised estimates for residential and commercial growth emissions increases in Table 6 (Emissions Increases from Residential and Commercial Growth Due to SPM) of Appendix D-2 of the plan approval application were mainly from projected emissions increases from mobile sources. Based on 40 CFR § 52.21(b)(18), emissions from mobile sources are not considered secondary emissions.

<sup>82</sup> *Code of Federal Regulations*. 40 CFR § 52.21(b)(18). Definition of "secondary emissions."

<sup>83</sup> The EPA's "Workbook for Plume Visual Impact Screening and Analysis (Revised) (EPA-454/R-92-023, October 1992)" provides a specific example on separating visibility impairment analysis based on plume heights on Page C-13.

<sup>84</sup> Workbook for Estimating Visibility Impairment (EPA-450/4-80-031, November 1980).

totally enclosed ground flares and the elevated, steam-assisted flare whereas ranged from 4 to 998 meters only for the rest of Shell's sources. Based on the two sets of Level-2 plume visual impact screening analysis conducted for the Raccoon Creek State Park using VISCREEN v13190 in accordance with the EPA's guidance,<sup>85</sup> impairment to visibility is expected to be negligible.

Shell provided a detailed description of the visibility impairment analysis in section 7.0 (Class II Visibility Analysis) of Appendix D-1 of the plan approval application.

### C. Soils and Vegetation

Shell also revised its previous soils and vegetation analysis, which were submitted as part of its application for Plan Approval 04-00740C, to account for the net emissions increase due to the EMAX Project and the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations. Based on the revised analyses, no adverse impacts to soils and vegetation are expected. Under the EPA's guidance,<sup>86</sup> emissions from Shell that are classified as "directing acting pollutants" include NO<sub>2</sub>, CO, SO<sub>2</sub>, beryllium, and lead whereas those classified as "trace metals" include arsenic, cadmium, chromium, cobalt, manganese, mercury, nickel, selenium, vanadium, and zinc. For NO<sub>2</sub>, CO, beryllium, and lead, the impacts calculated by AERMOD are less than the EPA's ambient screening concentrations.<sup>87</sup> For beryllium and lead, which are hazardous air pollutants (HAP), the impacts were based on air dispersion modeling conducted as part of Shell's inhalation risk assessment.<sup>88</sup> For SO<sub>2</sub>, which was not modeled, the updated net emissions increase is less than the EPA's SER.<sup>89</sup> For the trace metals, which are also HAPs, deposited soil concentrations and vegetation tissue concentrations were estimated from the impacts modeled for the purpose of Shell's inhalation risk assessment and are determined to be less than the EPA's soil and vegetation tissue screening concentrations.<sup>90</sup>

Shell provided a detailed description of the soils and vegetation analysis in section 2.0 (Potential Impacts to Soils and Vegetation) of Appendix D-2 of the plan approval application.

### D. Secondary NAAQS

The DEP notes that the EPA established secondary NAAQS to protect visibility and vegetation, among other things. The impacts of Shell's net emissions increase due to the EMAX Project and the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations are calculated by AERMOD to be less than the secondary NAAQS for annual NO<sub>2</sub> and 24-hour PM-10, based on NAAQS analyses for the revised PTE as summarized

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<sup>85</sup> Workbook for Plume Visual Impact Screening and Analysis (Revised) (EPA-454/R-92-023, October 1992).

<sup>86</sup> A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals (EPA 450/2-81-078, December 12, 1980).

<sup>87</sup> Ibid. Table 5-3.

<sup>88</sup> Appendix D-2 (Additional Impacts Analysis: Potential Growth Impacts and Impairment to Soils and Vegetation for Shell Polymers Monaca) of the Shell's plan approval application. September 5, 2025.

<sup>89</sup> A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals (EPA 450/2-81-078, December 12, 1980). Table 5.6.

<sup>90</sup> Ibid. Table 3.4.

previously in Table 10, and for annual PM-2.5 and 24-hour PM-2.5, based on an additional analyses for the EMACT Project as summarized previously in Table 11.

#### V. Class I Area Analyses for AQRVs and Visibility

Shell provided written notice of its EMACT Project, WWTP Permanent Controls Project, and Plan Approval Reconciliations to Federal Land Managers (FLM) of the following nearby federal Class I areas: Dolly Sods Wilderness and Otter Creek Wilderness, both in West Virginia, and Shenandoah National Park and James River Face Wilderness, both in Virginia.<sup>91</sup> The notice included initial screening calculations, which account for Shell’s net emissions increase due to the EMACT Project, in conjunction with the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations (Q) and distances (D) to these nearby federal Class I areas, to demonstrate that Shell’s emissions would have negligible impacts on AQRVs and visibility in these nearby federal Class I areas.<sup>92</sup> The FLM of each nearby federal Class I area stated that no analyses for AQRVs and visibility would be necessary.<sup>93,94</sup> Shell’s initial screening Q/D calculations are summarized in Table 18.

Table 18: Shell Initial Screening Q/D Calculations for Nearby Federal Class I Areas

Class I Area	Distance (D) from Shell Polymers Monaca Site	Shell Emissions(Q) <sup>[a]</sup> / Distance (D) Ratio	FLM Q/D Threshold
	km		
Dolly Sods Wilderness, WV	189	5.6	10
Otter Creek Wilderness, WV	200	5.3	
Shenandoah National Park, VA	269	3.9	
James River Face Wilderness, VA	347	3.1	

<sup>[a]</sup> Emissions (Q) equals the total SO<sub>2</sub>, NO<sub>x</sub>, PM-10, and H<sub>2</sub>SO<sub>4</sub> annual emissions (in tpy) based on 24-hour maximum allowable emissions. Q for Shell = 1,059 tpy.

Shell provided a detailed description of the Class I area analysis in subsection 8.1 (Class I AQRV Analysis) of Appendix D-1 of the plan approval application.

#### VI. Conclusions

The DEP’s technical review concludes that Shell’s air quality analyses for both the EMACT Project and for the WWTP Permanent Controls Project and Plan Approval Reconciliations, in conjunction with the revisions made by the DEP, satisfy the requirements of the PSD regulations.

In accordance with 40 CFR § 52.21(k), Shell’s source impact analyses demonstrate that the net emissions increase due to the EMACT Project would not cause or contribute to air pollution in

<sup>91</sup> E-mail with attachment from Aubrey Jones, Landau Associates to U.S. Forest Service and National Park Service representatives. September 6, 2024.

<sup>92</sup> U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, 2010. Federal Land Managers’ Air Quality Related Values Work Group (FLAG): Phase I Report – Revised (2010). Natural Resource Report NPS/NRPC/NRR – 2010/232. National Park Service, Denver, CO. Subsection 3.2.

<sup>93</sup> E-mail from Alexia Prosperi, U.S. Forest Service to Aubrey Jones, Landau Associates. September 17, 2024.

<sup>94</sup> E-mail from Andrea Stacy, National Park Service to Aubrey Jones, Landau Associates. October 9, 2024.

violation of the NAAQS for CO, NO<sub>2</sub>, and PM-2.5, or the Class II Area and Class I Area PSD increments for NO<sub>2</sub> and PM-2.5. Similar to the findings of previously conducted air quality analyses to support its applications for Plan Approvals 04-00740A and 04-00740C, Shell's revised source impact analyses demonstrate that the revised PTE for Shell Polymers Monaca Site that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations, in conjunction with the net emissions increase due to the EMACT Project, would not cause or contribute to air pollution in violation of the NAAQS for CO, NO<sub>2</sub>, and PM-10, or the Class II Area and Class I Area PSD increments for NO<sub>2</sub> and PM-10.

In accordance with 40 CFR § 52.21(l), Shell's estimates of ambient concentrations are based on applicable air quality models, databases, and other requirements specified in the EPA's *Guideline on Air Quality Models*<sup>95</sup> as well as the EPA's relevant air quality modeling policy and guidance.

In accordance with 40 CFR § 52.21(m), Shell provided an analysis of existing ambient air quality in the area that emissions from Shell Polymers Monaca Site would affect that included existing representative ambient monitoring data for CO, NO<sub>x</sub>, PM-10, and PM-2.5. Shell's emissions of H<sub>2</sub>SO<sub>4</sub> are not subject to and emissions of PM are exempt from the requirements of 40 CFR § 52.21(m).

In accordance with 40 CFR § 52.21(n), Shell provided all information necessary to perform the air quality analyses required by the PSD regulations, including all air dispersion modeling data necessary to estimate the air quality impacts of the net emissions increase due to the EMACT Project and the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations.

In accordance with 40 CFR § 52.21(o), Shell provided additional impact analyses of the impairment to visibility, soils, and vegetation that would occur as a result of the net emissions increase due to the EMACT Project, in conjunction with the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations. Based on Shell's latest analyses, no residential, commercial, nor industrial growth is expected from Shell Polymers Monaca Site.

In accordance with 40 CFR § 52.21(p), written notice of Shell's EMACT Project, WWTP Permanent Controls Project, and Plan Approval Reconciliations has been provided to the FLMs of nearby federal Class I areas. The notice included initial screening calculations that demonstrate that Shell's net emissions increase due to the EMACT Project, in conjunction with the revised PTE that accounts for the WWTP Permanent Controls Project and Plan Approval Reconciliations, would have negligible impacts on AQRVs and visibility in nearby federal Class I areas.

All input, output, and data files associated with Shell's air dispersion modeling for the PSD air quality analyses and the DEP's technical review thereof are available upon request.

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<sup>95</sup> *Code of Federal Regulations*. 40 CFR Part 51, Appendix W (Guideline on Air Quality Models).