

AIR DISPERSION MODELING PROTOCOL

Proposed West Virginia Steel Mill

Nucor Corporation

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January 2022

Project 213601.0130



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1. INTRODUCTION

Nucor Corporation (“Nucor”) is currently evaluating the potential construction of a new facility in West Virginia. Nucor is proposing to construct a new steel mill in the city of Apple Grove, West Virginia. Estimated potential emissions are anticipated to exceed the PSD major thresholds for particulate matter (PM), particulate matter with an aerodynamic diameter of 10 microns (PM₁₀), particulate matter with an aerodynamic diameter of 2.5 microns (PM_{2.5}), volatile organic compounds (VOC), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NO_x), and greenhouse gases (GHGs). The West Virginia Department of Environmental Protection (WVDEP) has codified the federal PSD permitting requirements in Title 45 of the West Virginia Code of State Rules (45 CSR) Section 14 and has full authority to implement this program through its United States Environmental Protection Agency (U.S. EPA) authorized State Implementation Plan (SIP).

This modeling protocol outlines the methodologies that will be used to conduct the air dispersion modeling analysis required under PSD permitting for the proposed project consistent with 45 CSR 14-10. Air dispersion modeling is relied upon to demonstrate that the proposed project complies with the applicable NAAQS and PSD Class II Increments for the pollutant(s) subject to PSD review.¹

With the submittal of the final New Source Review 45CSR14 (R14) application for this project, Nucor will provide electronic files associated with the PSD air dispersion modeling analysis of the proposed facility. Nucor will include those files associated with importing terrain elevations, building downwash, meteorological data, and AERMOD. Nucor will also provide to WVDEP a PSD air dispersion modeling report that includes plots indicating the location of the facility fence line and facility layout.

1.1 Background

The proposed location for the new mill is located in Mason County, which is designated by U.S. EPA as “unclassifiable” and/or “attainment” for the National Ambient Air Quality Standards (NAAQS) for ozone, CO, SO₂, PM₁₀, PM_{2.5}, and NO₂.² To demonstrate compliance with the NAAQS, Nucor is proposing to conduct air quality dispersion modeling for these pollutants. Note that since there are no NAAQS standards for PM, VOC, and GHGs, modeling of these pollutants are not required.

Figure 1-1 provides a general map of the facility location, showing roads and general boundaries of towns and other nearby municipalities. As can be seen from this figure, the land use near the facility is generally rural.

This overall protocol primarily relates to the requirements for Class II air quality areas. The area immediately surrounding the proposed Nucor facility and within the general ambient air quality airshed in which nearfield modeling is conducted (within 50 km) are designated as Class II areas. With regard to Class II impacts, this protocol describes the modeling that will be performed for each PSD triggering pollutant.

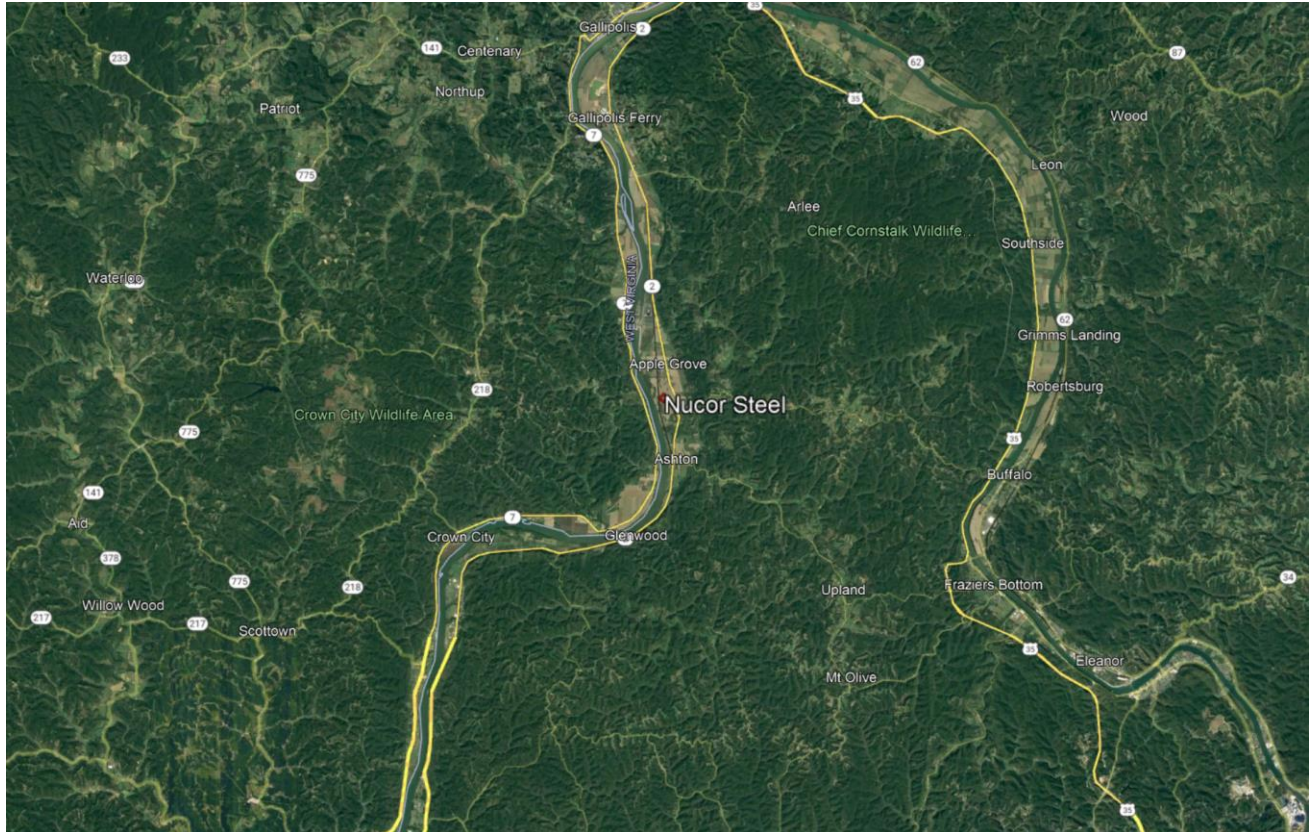
With respect to potential air quality impacts on Class I areas, Otter Creek Wilderness area is the closest Class I area to the proposed facility, located over 200 km from the site. Because the distance from the facility to the Class I area exceeds 50 km, Nucor plans to use screening methodologies to demonstrate the

¹ If a PSD Class I Increment analysis is required, a modeling protocol will be submitted under separate cover to WVDEP and the Federal Land Managers (FLMs) for the respective Class I areas.

² 40 CFR §81.349.

proposed project will not result in adverse impacts at Class I areas. A more robust regional modeling approach will be followed if required by the results of the screening analysis.

Figure 1-1. Area Map Showing Nucor’s Proposed Apple Grove, WV Facility Location



2. CLASS II DISPERSION MODELING REQUIREMENTS

Because sources and emissions in the proposed project are subject to the ambient air quality assessment requirements of the PSD program, modeling is required to meet specific objectives. Modeling will be used to demonstrate that emissions of CO, SO₂, NO₂, PM₁₀, and PM_{2.5} pollutants after the proposed project is completed will not:

- 1) cause or significantly contribute to a violation of the NAAQS,
- 2) cause or significantly contribute to ambient concentrations that are greater than allowable PSD Increments, or
- 3) cause any other additional adverse impacts to the surrounding area (i.e., impairment to visibility, soils and vegetation and air quality impacts from general commercial, residential, industrial, and other growth associated with the facility expansion).

To facilitate this analysis (and allow it to be commensurate with the requirements to which the WVDEP adheres), dispersion modeling methodologies will be followed that are consistent with EPA procedures specified in the *Guideline on Air Quality Models (Guideline)*.³ The purpose of this protocol is to provide an overview of the proposed techniques and models to be used and review the modeling objectives for each required element of the PSD air quality analysis.

Nucor will complete all dispersion modeling and air impact assessments required under the regulations for PSD. This will include all Class II area modeling analyses as required. The Class I area modeling analysis that is proposed is expected to demonstrate that more detailed regional scale modeling will not be needed and that only screening modeling will need to be considered. Class I area screening techniques to be implemented include the use of the so-called Q/D analysis for the Air Quality Related Value (AQRV) demonstrations, and an AERMOD analysis with receptors positioned at the extent of the nearfield analysis (50 km) for the Class I PSD Increment demonstration. In the event that more robust Class I modeling is required, a detailed Class I modeling approach will be submitted for approval.

For the Class II analysis the various stages of modeling that will be performed will be dependent on compliance at each step. To allow the WVDEP to evaluate the various levels of proposed modeling methodologies, this protocol outlines each stage of modeling in the sequence as if each would be used. The modeling steps will include the following steps if required:

- ▶ Step 1 - Determine if ambient air quality impacts of the proposed new sources are greater than or less than the Significant Impact Levels (SIL) on a per pollutant and per averaging time basis. Table 2-1 shows the applicable SILs and other important criteria pollutant thresholds for CO, SO₂, NO₂, PM₁₀, and PM_{2.5}. Please note that Nucor does not anticipate modeling any alternative operating or start-up/shutdown scenarios.

³ 40 CFR 51, Appendix W, *Guideline on Air Quality Models*, and 45 CSR 14-10

Table 2-1. Significant Impact Levels, NAAQS, PSD Class II Increments, and Significant Monitoring Concentrations for Applicable Criteria Air Pollutants

Pollutant	Averaging Period	PSD SIL ($\mu\text{g}/\text{m}^3$)	Primary NAAQS ($\mu\text{g}/\text{m}^3$)	Secondary NAAQS ($\mu\text{g}/\text{m}^3$)	Class II PSD Increment¹ ($\mu\text{g}/\text{m}^3$)	Significant Monitoring Concentration ($\mu\text{g}/\text{m}^3$)
CO	1-hour	2,000	40,000 (35 ppm) ²	--	--	--
	8-hour	500	10,000 (9 ppm) ²	--	--	575
SO ₂	1-hour	7.8	196 (75 ppb)	--	--	--
	3-hour	25	--	1,300 (500 ppb)	512	--
	24-hour	5	--	--	91	13
	Annual	1	--	--	20	--
NO ₂	1-hour	7.5 ³	188 (100 ppb) ⁴	--	--	--
	Annual	1	100 (53 ppb) ⁵	100 (53 ppb)	25	14
PM ₁₀	24-hour	5	150 ⁶	150	30	10
	Annual	--	-- ⁷	--	17 ⁷	--
PM _{2.5}	24-hour	1.2 ⁸	35 ⁹	35	9	4 ⁸
	Annual	0.2 ⁸	12 ¹⁰	15 ¹⁰	4	--

1. All short-term PSD Increments are not to be exceeded more than once per year.
2. Only a primary standard, not to be exceeded more than once per year.
3. No 1-hour NO₂ SIL has been promulgated by EPA. An interim SIL of 7.5 $\mu\text{g}/\text{m}^3$ (4 ppb) was selected based on the EPA Office of Air Quality Planning and Standards Memorandum from Ms. Anna Marie Wood to Regional Air Division Directors titled *General Guidance for Implementing the 1-hour NO₂ National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour NO₂ Significant Impact Level* (June 28, 2010).⁴
4. Only a primary standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average concentrations.
5. Annual arithmetic average.
6. Not to be exceeded more than three times in 3 consecutive years.
7. The EPA revoked the annual PM₁₀ NAAQS in 2006, but the annual PM₁₀ Class II PSD Increment remains in effect.
8. EPA Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program, April 2018
9. The 3-year average of the 98th percentile 24-hour average concentrations.
10. EPA published a final rule (78 FR 3086), with an effective date of March 18, 2013, that reduced the primary annual PM_{2.5} NAAQS from 15 $\mu\text{g}/\text{m}^3$ to 12 $\mu\text{g}/\text{m}^3$ and retained the secondary annual PM_{2.5} NAAQS at 15 $\mu\text{g}/\text{m}^3$. Both the primary and secondary standards are expressed as the 3-year average of the annual arithmetic average concentration.

- ▶ Step 2 - Perform NAAQS dispersion modeling if air modeling impacts are greater than the SILs (in Step 1) to estimate the NAAQS impacts of the new project sources and regional inventory sources on a combined basis. The screening distance for assessing nearby regional inventory sources will be based on the distances to project's maximum concentrations and the expected decrease in concentrations as a function of distance (what EPA terms the gradient of impact). Background concentrations from nearby representative ambient monitors will also be added to the total impacts of all sources.

⁴ <https://www.epa.gov/sites/default/files/2015-07/documents/appwno2.pdf>

- ▶ Step 3 - Perform PSD increment modeling if air modeling impacts are greater than the SILs (in Step 1) to estimate the PSD increment impacts of the new project sources as well as any regional inventory sources. The screening distance for assessing regional PSD increment consuming or expanding sources will also be based on the distances to Nucor's maximum concentrations and the expected area with the highest concentration gradient from Nucor's modeled sources.
- ▶ Step 4 – Prepare an “additional air impacts” analysis. This analysis will use the results of the Significance Analysis modeling in Step 1 to compare ambient impacts to the secondary NAAQS. Incremental air quality impacts due to growth in the local infrastructure that may result from added employees and attendant industries will be qualitatively evaluated. Finally, Class II area visibility impacts will be evaluated on a screening basis using EPA's VISCREEN model.⁵
- ▶ Step 5 – Address the ozone and secondary PM_{2.5} ambient impact analysis requirements by conducting a quantitative assessment of potential ozone impacts from the proposed project. The quantitative assessment will rely solely on the approach outlined in EPA's *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool*, published April 2019.⁶

The remainder of this protocol provides the tools and methods that will be employed to conduct the Class II dispersion modeling along with a short overview of the Class I screening methodology.

2.1 Model Selection

For Class II area modeling, a number of modeling guidelines are available to facilitate and provide detail on the methodologies required for conducting dispersion modeling for the proposed Nucor plants. In general, the air dispersion modeling analyses to be conducted will be in accordance with applicable EPA guidance documents, including the following:

- ▶ EPA's *Guideline on Air Quality Models*, 40 CFR Part 51, Appendix W (Published, January 17, 2017), which West Virginia cites by reference in Section 10 of 45 CSR 14.⁷
- ▶ EPA's AERMOD Implementation Guide (April 2021)⁸
- ▶ EPA's User's Guide for the AMS/EPA Regulatory Model – AERMOD (April 2021)⁹
- ▶ EPA's New Source Review Workshop Manual (Draft, October 1990)¹⁰

Given these guidance documents and typical modeling practices, Nucor will use the EPA-recommended AERMOD Model in its most recent Version 21112 released in April 2021. AERMOD is a refined, steady-state (both emissions and meteorology over a one hour time step), multiple source, dispersion model and was

⁵ Note that CO and GHGs are not visibility affecting pollutants; therefore, the Class II area visibility analysis will only address project emissions increase for NO_x and PM.

⁶ <https://www.epa.gov/sites/default/files/2019-05/documents/merps2019.pdf>

⁷ 40 CFR 51, Appendix W, Guideline on Air Quality Models

⁸ EPA, *AERMOD Implementation Guide*, April 2021, available at https://www3.epa.gov/ttn/scram/models/aermod/aermod_implementation_guide.pdf

⁹ *User's Guide for the AMS/EPA Regulatory Model (AERMOD)*, EPA-454/B-21-001, EPA, OAQPS, Research Triangle Park, NC, April 2021.

¹⁰ EPA, *New Source Review Workshop Manual*, Draft October 1990, available at <http://www.epa.gov/ttn/nsr/gen/wkshpman.pdf>

promulgated by EPA in December 2005 as the preferred model to use for industrial sources in this type of air quality analysis.¹¹ AERMOD will be used to model each stack, horizontal vent, and any other type of source at the facility. Nucor plans to apply AERMOD using the regulatory default options in all cases.

2.2 Tiered NO₂ Dispersion Modeling Methodology

In the “Models for Nitrogen Dioxide” section of the *Guideline* (Section 4.2.3.4), U.S. EPA recommends a tiered screening approach for estimating annual NO₂ impacts from point sources in PSD modeling analyses. Use of the tiered approach to NO₂ modeling for the 1-hour and annual NO₂ standard (SIL, NAAQS, and PSD Increment) will be considered. The approach used in each of the three tiers is described briefly below.

1. Under the initial and most conservative Tier 1 screening level, all NO_x emitted is modeled as NO₂ which assumes total conversion of NO (main chemical form of NO_x) to NO₂.
2. For the Tier 2 screening level, U.S. EPA recommends multiplying the Tier 1 results by the Ambient Ratio Method 2 (ARM2), which provides estimates of representative equilibrium ratios of NO₂/NO_x based on ambient levels of NO₂ and NO_x derived from national data from the EPA’s Air Quality System (AQS). The ARM2 function, which is a default option within the latest version of AERMOD, will be used to complete this multiplication. The default minimum ambient NO₂/NO_x ratio of 0.5 and maximum ambient ratio of 0.9 will be used for this methodology.
3. Since the impact of an individual NO_x source on ambient NO₂ depends on the chemical environment into which the source’s plume is emitted, modeling techniques that account for this atmospheric chemistry such as the Ozone Limiting Method (OLM) or the Plume Volume Molar Ratio Method (PVMRM) can be considered under the most accurate and refined Tier 3 approach identified by U.S. EPA. Additional model inputs required for the use of OLM or PVMRM could include source-specific in-stack NO₂/NO_x ratios, ambient equilibrium NO₂/NO_x ratios, and background ozone concentrations.

Nucor intends to use a Tier 2 NO₂ modeling approach using the regulatory-approved EPA default settings. Nucor reserves the right to modify this methodology at a future date and will submit a revised modeling protocol for WVDEP approval prior to final modeling should a Tier 3 approach be required.

2.3 Rural/Urban Option Selection in AERMOD

For any dispersion modeling exercise, the “urban” or “rural” determination of the area surrounding the subject source is important in determining the applicable atmospheric boundary layer characteristics that affect a model’s calculation of ambient concentrations. Thus, a determination will need to be made of whether the area around the facility is urban or rural.

The first method discussed in Section 5.1 of the *AERMOD Implementation Guide* (also referring therein to Section 7.2.3c of the *Guideline on Air Quality Models, Appendix W*) is called the “land use” technique because it examines the various land use within 3 km of a source and quantifies the percentage of area in various land use categories. If greater than 50% of the land use in the prescribed area is considered urban, then the urban option should be used in AERMOD. However, EPA cautions against the use of the “land use” technique for sources close to a body of water because the water body may result in a predominately rural land use classification despite being located in an urban area. If necessary, the second recommended urban/rural classification method in Appendix W Section 7.2.1.1.b is the Population Density Procedure. This technique evaluates the total population density within 3-kilometers of a source. If the population density is

¹¹ 40 CFR 51, Appendix W—*Guideline on Air Quality Models*, Appendix A.1—AMS/EPA Regulatory Model (AERMOD).

greater than 750 people per square kilometer, then EPA recommends the use of urban dispersion coefficients.

Based on aerial imagery of the area surrounding the proposed facility location in Apple Grove, nearby land use is overwhelmingly rural. Nucor plans to confirm this conclusion using the aforementioned techniques recommend by EPA, the results of which will be provided in the modeling report.

2.4 Building Downwash

The *Guideline* requires the evaluation of the potential for physical structures to affect the dispersion of emissions from stack sources. The exhaust from stacks that are located within specified distances of buildings may be subject to “aerodynamic building downwash” under certain meteorological conditions. This determination is made by comparing actual stack height to the Good Engineering Practice (GEP) stack height. The modeled emission units will be evaluated in terms of their proximity to nearby structures.

In accordance with recent AERMOD updates, an emission point is assumed to be subject to the effects of downwash at all release heights even if the stack height is above the U.S. EPA formula height, which is defined by the following formula:

$$H_{\text{GEP}} = H + 1.5L, \text{ where:}$$

where,

- H_{GEP} = GEP stack height,
- H = structure height, and
- L = lesser dimension of the structure (height or maximum projected width).

This equation is limited to stacks located within 5L of a structure. Stacks located at a distance greater than 5L are not subject to the wake effects of the structure.

Direction-specific equivalent building dimensions used as input to the AERMOD model to simulate the impacts of downwash will be calculated using the U.S. EPA-sanctioned Building Profile Input Program (BPIP-PRIME), version 04274 and used in the AERMOD Model.¹² BPIP-PRIME is designed to incorporate the concepts and procedures expressed in the GEP Technical Support document, the Building Downwash Guidance document, and other related documents and has been adapted to incorporate the PRIME downwash algorithms.¹³

A GEP analysis of all modeled point sources in relation to each building will be performed to evaluate which building has the greatest influence on the dispersion of each stack’s emissions. The GEP height for each stack calculated using the dominant structure’s height and maximum projected width will also be determined. According to U.S. EPA dispersion modeling guidance, stacks with actual heights greater than either 65 meters or the calculated GEP height, whichever is greater, generally cannot take credit for their full stack height in a PSD modeling analysis. All modeled source stacks are less than 65 meters tall and

¹² Earth Tech, Inc., Addendum to the ISC3 User’s Guide, The PRIME Plume Rise and Building Downwash Model, November 1997, <http://www.epa.gov/scram001/7thconf/iscprime/useguide.pdf>.

¹³ U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (Revised)*, Research Triangle Park, North Carolina, EPA 450/4-80-023R, June 1985.

therefore meet the requirements of GEP and credit for the entire actual height of each stack is used in this modeling analysis.

2.5 Elevated Terrain

Terrain elevations will be considered in the modeling analysis. The elevations of receptors, buildings, and sources will refine the modeling impacts between the sources at one elevation and receptor locations at various other elevations at the fence line and beyond. This will be accomplished through the use of the AERMOD terrain preprocessor called AERMAP (latest version 18081), which generates base elevations above mean sea level of sources, buildings, and/or receptors as specified by the user. For all receptors, AERMAP will determine the base elevation of each and an effective hill height scale that determines the magnitude of each source plume-elevated terrain feature interaction. AERMOD uses both of these receptor-related values to calculate the effect of terrain on each plume. Base elevations for select sources and buildings, terrain elevations for receptors, and other regional source base elevations (if required in the NAAQS modeling analysis) input to the model will be read and interpolated from 1 arc second (approximately 30 meter resolution) National Elevation Dataset (NED) data obtained from the U.S. Geological Survey (USGS).¹⁴ The NED data will extend well beyond the extent of the modeled receptor grids to properly calculate the receptor elevations and hill-height scales.

2.6 Meteorological Data

For performing the Class II modeling in AERMOD, meteorological data must be preprocessed to put it into a format that AERMOD can use. This will be accomplished using the AERMET processor (Version 21112) along with nearby sets of National Weather Service (NWS) data from surface and upper air stations. The AERSURFACE program (Version 20060) was used to generate the three critical parameters used in AERMET, namely, albedo, Bowen Ratio (ratio of sensible heat to latent heat), and the surface roughness. Values for those land use parameters were tabulated for both the meteorological data site and proposed project site to confirm that the airport NWS stations are reasonably representative of the project site.

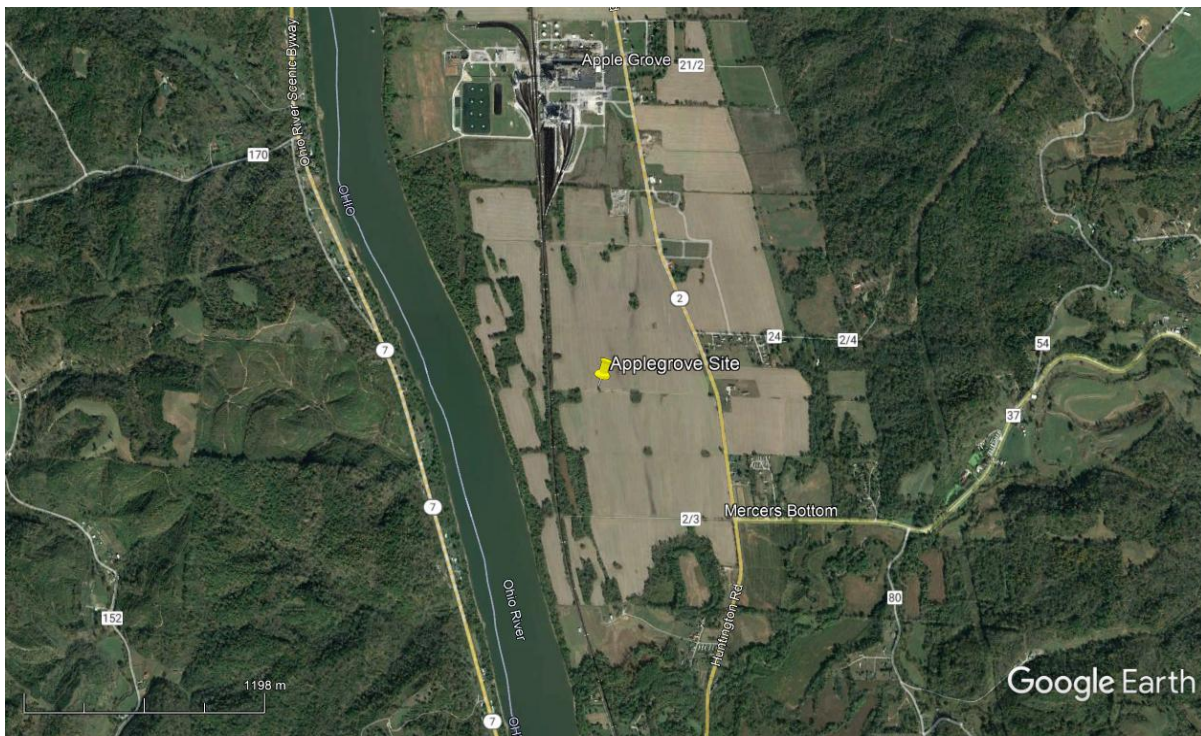
For the proposed Apple Grove location, the closest surface meteorological data station is the Huntington Tri-State Airport (KHTS, WBAN #3860) located about 46 kilometers to the southeast. Given the location of the project site, there are very few representative meteorological data options available. Figures 2-1 and 2-2 present aerial images of the immediate area surrounding the airport station and project locations, respectively.

¹⁴ U.S. Geological Survey, USGS 3D Elevation Program (3DEP), accessed April 6, 2021 at <https://apps.nationalmap.gov/downloader/#/>

Figure 2-1. Aerial Image of Huntington Airport



Figure 2-2. Aerial Image of Apple Grove Site Location



As shown, both sites are located in rural areas in rolling terrain. Table 2-2 presents a comparison of the albedo, Bowen ratio and surface roughness for each location.

Table 2-2. Comparison of Land Use Parameters – Huntington vs. Apple Grove

Sector (degrees)	Huntington Airport			Nucor Applegrove			Percent Diff. [(Facility-NWS)/Facility] ¹		
	Albedo (unitless)	Bowen Ratio (unitless)	Surface Roughness (m)	Albedo (unitless)	Bowen Ratio (unitless)	Surface Roughness (m)	Albedo (%)	Bowen Ratio (%)	Surface Roughness (%)
0-30	0.163	0.693	0.148	0.160	0.633	0.111	-1.56%	-9.49%	-33.86%
30-60	0.163	0.693	0.274	0.160	0.633	0.112	-1.56%	-9.49%	-145.19%
60-90	0.163	0.693	0.143	0.160	0.633	0.103	-1.56%	-9.49%	-39.27%
90-120	0.163	0.693	0.127	0.160	0.633	0.109	-1.56%	-9.49%	-16.06%
120-150	0.163	0.693	0.450	0.160	0.633	0.114	-1.56%	-9.49%	-295.60%
150-180	0.163	0.693	0.358	0.160	0.633	0.121	-1.56%	-9.49%	-194.85%
180-210	0.163	0.693	0.155	0.160	0.633	0.107	-1.56%	-9.49%	-45.54%
210-240	0.163	0.693	0.232	0.160	0.633	0.027	-1.56%	-9.49%	-767.29%
240-270	0.163	0.693	0.263	0.160	0.633	0.023	-1.56%	-9.49%	-1029.03%
270-300	0.163	0.693	0.148	0.160	0.633	0.028	-1.56%	-9.49%	-423.89%
300-330	0.163	0.693	0.072	0.160	0.633	0.148	-1.56%	-9.49%	51.02%
330-360	0.163	0.693	0.096	0.160	0.633	0.109	-1.56%	-9.49%	11.90%
All	0.163	0.693	0.205	0.160	0.632	0.093	-1.56%	-9.49%	-121.97%

¹ Percent Difference [(Facility-NWS)/Facility] compares the average of the overall albedo, Bowen ratio, and surface roughness values for the Huntington Airport to the proposed Apple Grove site.

The albedo and Bowen ratio are very comparable at both sites. There are some sectors where the surface roughness varies between the two locations, which is almost always the case when comparing greenfield industrial sites to airports. The Huntington airport has forested areas within the 1-km surface roughness evaluation radius which is driving the average values up. In the case of the project site, the surface roughness based on the 2016 NLCD data is an underestimate since the as-built site will have numerous buildings and roughness elements. Once constructed, the site will have surface roughness even more similar to Huntington airport.

In order to evaluate the potential impact of post-construction land use changes, Nucor used the ARCVIEW GIS program to modify the land use cells in the 2016 NLCD to reflect as-built land use types. The latest version of AERSURFACE utilizes three (3) types of land use files (land cover, impervious surface, and tree canopy). Nucor revised these files to reflect the post-construction land use parameters and then ran AERSURFACE again, using the modified land use files. Table 2-3 presents the surface characteristic comparison after construction of the proposed mill.

Table 2-3. Comparison of Land Use Parameters – Huntington vs. Modified Apple Grove

Sector (degrees)	Huntington Airport			Nucor Applegrove			Percent Diff. [(Facility-NWS)/Facility]		
	Albedo (unitless)	Bowen Ratio (unitless)	Surface Roughness (m)	Albedo (unitless)	Bowen Ratio (unitless)	Surface Roughness (m)	Albedo (%)	Bowen Ratio (%)	Surface Roughness (%)
0-30	0.163	0.693	0.148	0.160	0.635	0.261	-1.56%	-9.06%	43.25%
30-60	0.163	0.693	0.274	0.160	0.635	0.162	-1.56%	-9.06%	-69.14%
60-90	0.163	0.693	0.143	0.160	0.635	0.139	-1.56%	-9.06%	-3.07%
90-120	0.163	0.693	0.127	0.160	0.635	0.151	-1.56%	-9.06%	16.23%
120-150	0.163	0.693	0.450	0.160	0.635	0.188	-1.56%	-9.06%	-139.36%
150-180	0.163	0.693	0.358	0.160	0.635	0.223	-1.56%	-9.06%	-60.31%
180-210	0.163	0.693	0.155	0.160	0.635	0.126	-1.56%	-9.06%	-22.77%
210-240	0.163	0.693	0.232	0.160	0.635	0.031	-1.56%	-9.06%	-654.47%
240-270	0.163	0.693	0.263	0.160	0.635	0.026	-1.56%	-9.06%	-909.62%
270-300	0.163	0.693	0.148	0.160	0.635	0.036	-1.56%	-9.06%	-308.28%
300-330	0.163	0.693	0.072	0.160	0.635	0.204	-1.56%	-9.06%	64.50%
330-360	0.163	0.693	0.096	0.160	0.635	0.234	-1.56%	-9.06%	58.91%
All	0.163	0.693	0.205	0.160	0.635	0.148	-1.56%	-9.06%	-38.42%

¹ Percent Difference [(Facility-NWS)/Facility] compares the average of the overall albedo, Bowen ratio, and surface roughness values for the Huntington Airport to the proposed Apple Grove site.

As shown in Table 2-3, the land use characteristics at the airport and facility will be much more comparable when considering the changes due to construction, with the surface roughness values differing by less than 40% on average. Based on the above land use comparisons, Nucor believes the meteorological conditions at Huntington Tri-State Airport are representative of those expected at the proposed Apple Grove site location.

To further supplement these land use comparisons, Nucor will conduct a sensitivity analysis as referenced in Section 3.1.1 of the *AERMOD Implementation Guide*. The analysis will include two sets of meteorological data for the site, the first incorporating the land use parameters for the proposed site and the second using the land use parameters for the representative airport location. Using these sets of meteorological data, Nucor will model representative emission sources (i.e., a volume source, a point source, an elevated point source) from the proposed facility for both short term and long-term averaging periods. Nucor will compare these results to determine the significance of the differences in concentrations resulting from differences in the surface characteristics between the proposed site location and the nearby airport. Nucor will validate the sensitivity analysis with WVDEP prior to conducting significance modeling and the results will be provided in the final modeling report.

The most recent, readily available full five years of meteorological data for both sites is 2016-2020. These years will be used in the air quality modeling analysis. The latest version of AERMET (version 21112) will be used to incorporate 1-minute ASOS wind data using EPA's AERMINUTE (version 15272) meteorological data preprocessor. Standard surface NWS data will be obtained from the index of published data sets available from the National Climatic Data Center (NCDC) for the appropriate years¹⁵. The proposed project site will utilize upper air data from Pittsburgh International Airport (KPIT, WBAN #94823). Those upper air data will be obtained from the National Oceanic and Atmospheric Administration NOAA/ESRL Radiosonde Database¹⁶

¹⁵ <ftp://ftp.ncdc.noaa.gov/pub/data/noaa/>

¹⁶ <http://www.esrl.noaa.gov/raobs/>

and the one-minute/five-minute wind speed and wind direction data for the same surface station from NCDC¹⁷.

Because the meteorology generated by AERMET relies on the land surface in the vicinity of the NWS surface site, land cover/land use data (National Land Cover Data, NLCD) will be determined from that available from the United States Geological Survey through the MRLC Consortium viewer platform¹⁸. The AERSURFACE program (Version 20060) will be used to generate the three critical parameters used in AERMET, namely, albedo, Bowen Ratio (ratio of sensible heat to latent heat), and the surface roughness parameter. These will be based on wet, dry, and average moisture conditions as determined by comparing the seasonal rainfall amounts to the 30-year averages and using the upper and lower 30th percentiles of average rainfall based on 1991-2020 data for the nearest recording NWS site.

A minimum threshold wind speed of 0.5 m/s (the lowest wind speed that will be allowed in the generated meteorological data set) will be implemented in AERMET, as suggested in Section 4.6.2.2 of the latest *AERMET User's Guide*.¹⁹ All hours with wind speeds below this value will be treated as "calm" in AERMOD.

2.7 Coordinate System

In all modeling analyses conducted by Nucor, the location of emission sources, structures, and receptors will be represented in the Universal Transverse Mercator (UTM) coordinate system. The UTM grid divides the world into coordinates that are measured in north meters (measured from the equator) and east meters (measured from the central 500 km meridian of each UTM zone, where the world is divided into 36 north-south zones). The datum for the Nucor modeling analysis is based on North American Datum 1983 (NAD 83). UTM coordinates for this analysis all reside within UTM Zone 17 which will serve as the reference point for all data as well as all regional receptors and sources.

2.8 Receptor Grids

For the Class II air dispersion modeling analyses, ground-level concentrations will be calculated from the fence line out to either 10 km for the 1-hour CO, 8-hour CO, 1-hour SO₂, 3-hour SO₂, 24-hour SO₂, annual SO₂, annual NO₂, annual PM₁₀, 24-hour PM₁₀, annual PM_{2.5} and 24-hour PM_{2.5} analyses or 50 km for the 1-hour NO₂ analyses using a series of nested receptor grids. These receptors will be used in the Significance analysis, in the PSD increment modeling, and in the overall NAAQS modeling. The following nested grids will be used to determine the extent of significance:

- ▶ **Fence Line Grid:** "Fence line" grid consisting of evenly-spaced receptors 50 meters apart placed along the main property boundary of the facility,
- ▶ **Fine Cartesian Grid:** A "fine" grid containing 100-meter spaced receptors extending approximately 3 km from the center of the property and beyond the fence line,
- ▶ **Medium Cartesian Grid:** A "medium" grid containing 500-meter spaced receptors extending from 3 km to 10 km from the center of the facility, exclusive of receptors on the fine grid,

¹⁷ <ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin>

¹⁸ <http://www.mrlc.gov/viewerjs/>

¹⁹ EPA, *User's Guide for the AERMOD Meteorological Preprocessor (AERMET)*, EPA-454/B-21-004, U.S. Environmental Protection Agency, Research Triangle Park, NC, April 2021.

- ▶ **Coarse Cartesian Grid:** A “coarse grid” containing 1,000-meter spaced receptors extending from 10 km to 30 km from the center of the facility, exclusive of receptors on the fine and medium grids, and
- ▶ **Very Coarse Cartesian Grid:** A “very coarse grid” containing 2,500-meter spaced receptors extending from 30 km to 50 km from the center of the facility, exclusive of receptors on the fine, medium, and coarse grids.

This configuration and extent will capture the area of maximum modeled concentrations. If maximum modeled concentrations are located in an area with less than 100-meter receptor density, then the receptor density will be increased accordingly. Similarly, if maximum impacts are identified near the extents of the receptor grid, then the receptor grid will be expanded to ensure the maximum modeled concentrations are appropriately captured. Concentration plots depicting the maximum modeled concentrations and surrounding impacts will be provided in the final modeling report to provide confidence that the maximum impact is identified.

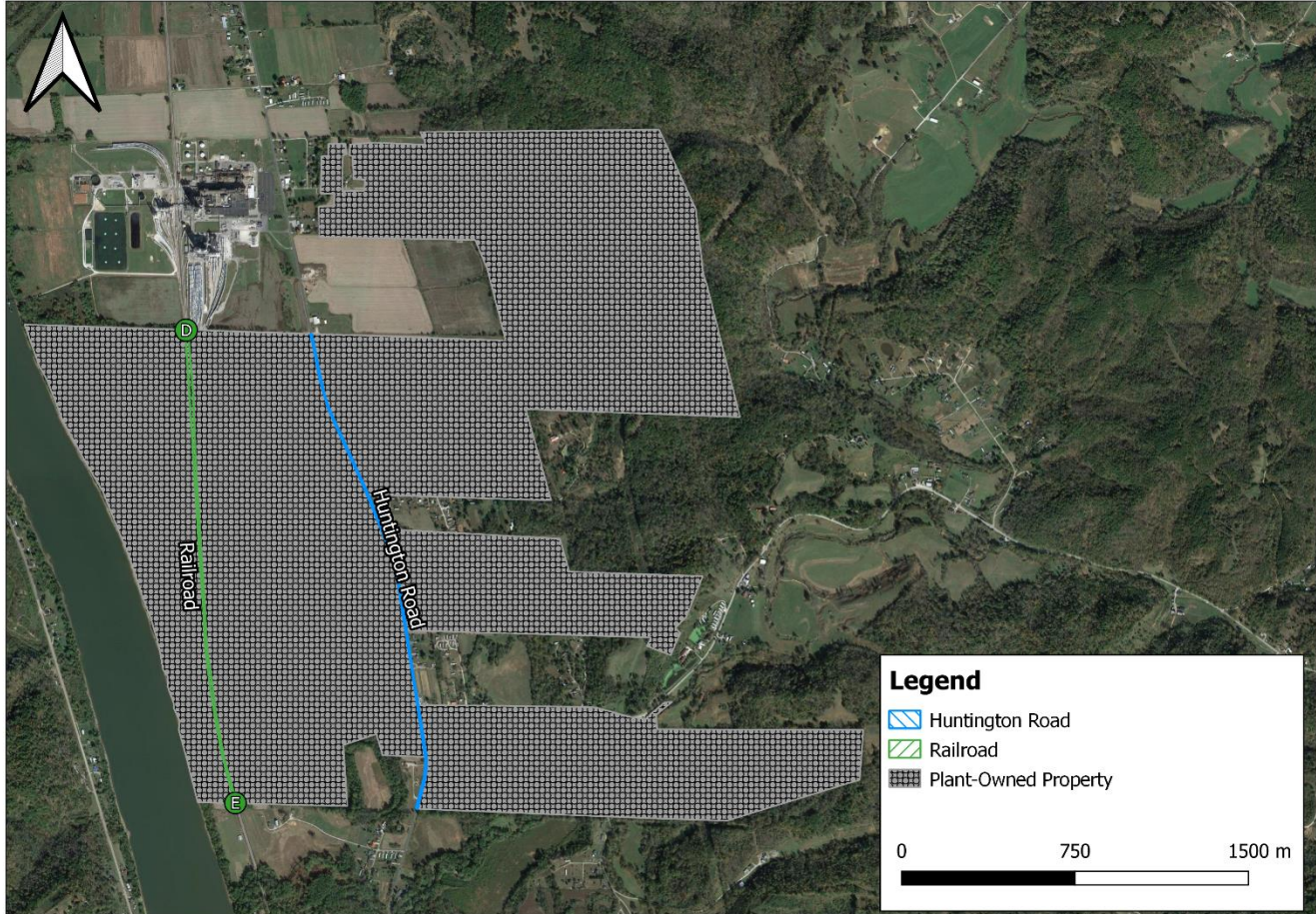
The full NAAQS and PSD increment analyses will be conducted using only receptor locations at which impacts calculated for the facility sources exceed the SIL for the respective pollutant and averaging time. As compliance with the PSD increment analysis and NAAQS is only required in areas regulated as “ambient air,” in developing the receptor grid for the modeling analysis, Nucor will exclude all company owned property to which general public access is restricted because it is fenced or access is otherwise restricted, and thus, will not be considered “ambient air.”

Figure 2-3 displays the property boundaries for the Apple Grove site. At the Apple Grove site, a main railroad line (entry/exit points labeled “D” and “E”) passes through the center of the property. Please note that this figure has been provided for demonstration purposes as Nucor has not finalized the design of the facility. The quantity and location of access points (including Nucor employee access) is expected to change and will be included in the final modeling report.

Nucor notes that railroad tracks and rights-of-way are private property and access by the general public is considered trespassing per W. Va. Code § 61-3B-3. This rule states, “It is an unlawful trespass for any person to knowingly, and without being authorized, licensed or invited, to enter or remain on any property, other than a structure or conveyance, as to which notice against entering or remaining is either given by actual communication to such person or by posting, fencing or cultivation.”

For the proposed facility location, Nucor will restrict general public access via physical fencing, signage at all entry and exit points, remote monitoring (e.g., 24-hour video surveillance), and on-site security staffing. Remote monitoring will provide Nucor constant surveillance of all facility access points and dedicated security staff will respond immediately to any potential trespassing incidents. Furthermore, Nucor intends to establish routine security patrols to allow passageway to authorized personnel while monitoring and further deterring unauthorized general public access at all entry and exit points. Through these security measures, Nucor will preclude general public access and minimize all transient access to the proposed facility property. Therefore, Nucor will exclude receptors from the industrial plant roadways and main line railroads that cross the facility property.

Figure 2-3. Property Boundaries of Nucor’s Proposed Apple Grove, WV Property



2.9 Emission Sources and Regional Source Inventories

Dispersion modeling for the significance analysis will be conducted for all new sources using hourly or annual potential CO, SO₂, PM₁₀, PM_{2.5}, and NO_x emission rates, where applicable, based on the averaging period of the underlying NAAQS or PSD Increment standard. As per PSD modeling requirements, for any off-site air concentration impact calculated that is greater than the SIL for a given pollutant, the radius of the significant impact area (SIA) will be determined based on the extent to where the farthest receptor is located at which the SIL is exceeded. Thus, the SIA will encompass a circle centered on the facility with a radius extending out to either (1) the farthest location where the emissions of a pollutant causes a significant ambient [i.e., modeled impact above the SIL on a high-first-high (HFH) basis] or (2) a maximum distance of 50 km, whichever is less.²⁰ Under EPA’s previous guidance in Section IV.C.1 of the draft *New Source Review Manual* applicable to “deterministic” NAAQS, all sources within the SIA no matter how small or distant would be included in the regional inventory, and the remaining sources outside of the SIA but within 50 km would be assumed to potentially contribute to ground-level concentrations within the SIA and

²⁰ This is the maximum extent of the applicability of the AERMOD Model as per the *Guideline on Air Quality Models*.

would be evaluated for possible inclusion in the NAAQS analysis.²¹ An applicant would determine the SIA for each pollutant and averaging period and would use these calculations to determine which regional sources needed to be included in the NAAQS analysis. Sources in the raw inventories provided by state agencies would first be screened to remove sources located outside of the radius of impact (ROI) [i.e., the significant impact area (SIA) plus 50 km]. The remaining sources within the ROI would then be screened based on an emissions (Q) over distance (d) screening technique such as the "20D" procedure to identify small and distant sources that could be excluded from the NAAQS analysis because they were not anticipated to impact receptors in the SIA.²² For deterministic NAAQS like the annual NO₂ standard, this procedure is generally still valid and will be used if modeled impacts from the Significance Analysis exceed the SIL.

For short-term probabilistic NAAQS like the 1-hour NO₂ standard, this procedure often produces an inordinately large number of regional inventory sources due to larger SIA distances caused by peak hourly impacts during certain low frequency meteorological events. Recognizing the limitations of the NSR Manual procedure developed at a time when no probabilistic 1-hour NAAQS were in effect, EPA now recommends a different regional inventory screening procedure focusing primarily on the concentration gradient of the source and professional judgement by the dispersion modeler. As indicated in Appendix W, EPA states that "the number of nearby sources to be explicitly modeled in the air quality analysis is expected to be few except in unusual situations [and] in most cases, the few nearby sources will be located within the first 10 to 20 km from the source(s) under consideration." As such, Nucor will employ a subjective screening analysis in addition to the quantitative methods described above. Justification for inclusion or exclusion of specific regional sources will be included in the final modeling report.

As needed, CO, SO₂, NO₂, PM₁₀ and PM_{2.5} regional source inventories will be compiled for the NAAQS and PSD Increment analyses. Source locations, stack parameters, annual operating hours, and potential emissions data will be obtained from WVDEP, Ohio EPA (OEPA), Pennsylvania DEP (PADEP), and/or file reviews of specific facilities.

The first screening step in the regional inventory screening process will be to apply the objective procedure outlined in the NSR Manual which EPA still considers to "generally be acceptable as the basis for permitting decisions, contingent on an appropriate accounting for the monitored contribution."²³ All sources within the SIA for the specific averaging period will be retained for further consideration in the remaining screening steps of the analysis, and any sources beyond the SIA but within this ROI will be screened using the "20D" procedure. Under this Q/d-based screening procedure, sources outside the SIA will be excluded from the inventories for short-term averaging periods if the entire facility's emissions (tpy) are less than 20 times the distance (km) from the facility to Nucor, and sources outside the SIA will be excluded from the inventories for annual averaging periods if the entire facility's emissions (tpy) are less than 20 times the distance (km) from the facility to the nearest edge of the SIA. In addition, the locations of the included and excluded regional sources based on the results of the "20D" screening analysis will be plotted in maps presented as part of an appendix to the modeling report. These plots will be reviewed to determine if any sources eliminated by the "20D" rule were in close enough proximity to one another that they could be considered a "cluster." The combined Q/d value for each identified cluster will be calculated using GIS software. If the aggregate Q/d for a cluster exceeds 20, the sources within the cluster excluded from the inventory on the

²¹ EPA, *New Source Review Workshop Manual*, Draft October 1990, available at <http://www.epa.gov/ttn/nsr/gen/wkshpman.pdf>

²² 57 FR 8079, March 6, 1992.

²³ U.S. EPA Memorandum from Tyler Fox, *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO₂ National Ambient Air Quality Standard*, March 1, 2011.

basis of their individual facility Q/d value will be further evaluated for possible inclusion in the NAAQS/PSD Increment analyses. For each step in the regional inventory screening process, Excel spreadsheets and associated regional inventory summary tables will be included as an appendix to the modeling report to provide documentation of each emission unit removed from the inventory and each unit retained for inclusion in the NAAQS and PSD Increment analyses.

After completing the screening analysis, the remaining inventory sources will then be evaluated to determine whether any refinements to the data set are warranted or if the source could be removed from the inventory based on site-specific considerations. The two main problems expected to be encountered in finalizing the model input parameters for the remaining inventory sources are: 1) missing/non-representative stack parameters, and 2) overestimated potential emission rates due to overlapping process designations in the emissions inventory premised on continuous annual operation in multiple operating modes (i.e., one process ID for a boiler designating 8,760 hr/yr of operation at the maximum burner rating when firing natural gas and a second process ID designating 8,760 hr/yr of fuel oil firing). Missing/non-representative stack parameters for point sources will be filled based on the best available data for the source in question. To aid in the WVDEP's review of the model input parameters assigned to regional sources, all of the assumptions and resources used for filling or correcting stack parameters will be documented through highlighting and embedded comments in the regional inventory spreadsheets. These modified parameters will be further documented through footnotes to the regional inventory model input parameter summary tables. Nucor will work with WVDEP to validate these model input parameters and finalize any required regional inventories.

If a modeled exceedance is observed on property of a nearby source, then the so called "Mitsubishi Method" may be employed to demonstrate compliance at those on-property receptor locations.²⁴ Specifically, Nucor and the nearby sources will be modeled to obtain total concentrations at all receptor locations. Where a receptor is located on a nearby source's non-ambient air property, the contribution from that specific nearby source may be subtracted from the total concentrations.

2.10 Ambient Monitoring Requirements

Under current U.S. EPA policies, the maximum impacts attributable to the emissions increases from a project must be assessed against monitoring *de minimis* levels to determine whether pre-construction monitoring should be considered. A pre-construction air quality analysis using continuous monitoring data can be required for pollutants subject to PSD review per 40 CFR § 52.21(m). The monitoring *de minimis* levels are provided in 40 CFR § 52.21(i)(5)(i) and are listed in Table 2.1. If either the predicted modeled impact from the proposed project or the existing ambient concentration is less than the monitoring *de minimis* concentration, the permitting agency has the discretionary authority to exempt an applicant from pre-construction ambient monitoring.

When not exempt, an applicant may provide existing data representative of ambient air quality in the affected area or, if such data are not available, collect background air quality data. However, this requirement can be waived if representative background data have been collected and are available. To satisfy the PSD pre-construction monitoring requirements, Nucor proposes that existing monitoring data provide reasonable estimates of the background pollutant concentrations for the pollutants of concern. The representativeness of existing monitoring data is outlined further in Section 2.11. For this reason, Nucor believes that pre-construction monitoring will not be required for this project.

²⁴ U.S. EPA Memorandum from Robert D. Bauman (Chief SO₂/Particulate Matter Programs Branch) to Gerald Fontenot (Chief Air Programs Branch, Region VI), *Ambient Air*, October 17, 1989

2.11 Background Concentrations

Ambient background monitoring concentrations are necessary for any required full NAAQS analysis for the facility. Nearby ambient background monitoring stations were reviewed, and nominations for candidate monitors for SO₂, NO₂, PM₁₀, PM_{2.5}, and ozone concentrations will be made on the basis of monitor sites with data for the required pollutants, proximity, and representativeness (based on similar land use and geographical setting). Based on the high magnitude of the 1-hour and 8-hour SIL for CO, Nucor does not anticipate triggering a full NAAQS analysis for CO, and thus, selection of a representative CO monitoring location is not presented in this Modeling Protocol. The following stations were chosen as appropriately representative ambient background monitoring stations for the pollutants indicated. The monitors selected are:

- ▶ Apple Grove, WV Proposed Facility Location
 - PM_{2.5}/Ozone – Huntington Site (AQS Site ID 54-011-0007)
 - PM₁₀ – Ironton Site (AQS Site ID 39-087-0012)
 - SO₂/NO₂ – Ashland Site (AQS Site ID 21-019-0017)

For Apple Grove, the Huntington site was chosen for Ozone and PM_{2.5} consideration due to its proximity, about 35 km southwest, and similar geographic location to the proposed facility. It is the closest monitor to the Apple Grove facility. For PM₁₀ consideration, the Ironton monitor was chosen, as again it is the closest monitor to the facility, about 45 km southwest, and has a similar geographic location adjacent to the Ohio River.

For SO₂ consideration, the nearest monitors to the proposed site are located in Cheshire, OH and Point Pleasant, WV, approximately 33 km north of the site and within the vicinity of the Gavin Power Plant. Considering the Gavin Power Plant is expected to be included in the regional inventory for the site, using the Cheshire or Point Pleasant monitors would result in “double-counting” of nearby source impacts. The next closest SO₂ monitor is in Ashland, KY approximately 46 km southwest of the proposed Apple Grove site. The location of this monitor would not be subject to the same nearby source influences described above and is expected to provide a more representative estimate of SO₂ background. For NO₂ consideration, the Ashland, KY monitor is the closest NO₂ monitor to the proposed site, approximately 46 km southwest. Therefore, Nucor is proposing to use the Ashland monitoring station for both NO₂ and SO₂ background concentrations.

For pollutants where diurnal and seasonal patterns of monitored concentrations are frequently present (i.e., 1-hour NO₂, 1-hour SO₂, and 24-hour PM_{2.5}), Nucor will first evaluate the design values for each pollutant and averaging period for use in the modeling. Should those values be overly conservative, Nucor intends to rely upon refined background concentrations in accordance with EPA guidance. For these pollutants, more refined “second tier” background concentrations are expected to be used. Concentration values that vary by season and hour of day are intended for use for 1-hour NO₂ and SO₂ and concentrations values that vary by season are intended for use for 24-hr PM_{2.5}. The temporarily varying concentration values will be developed based on recommendations in current EPA guidance.^{25,26}

²⁵ https://www.epa.gov/sites/default/files/2015-07/documents/appwno2_2.pdf

²⁶ https://www.epa.gov/system/files/documents/2021-09/revise_draft_guidance_for_o3_pm25_permit_modeling.pdf

3. CLASS I AREA DISPERSION MODELING ANALYSIS

There are two Class I areas within 300 km of the proposed facility, Otter Creek Wilderness and Dolly Sods Wilderness. Shenandoah National Park and James River Face Wilderness are located outside the 300 km screening range. The closest Class I area is Otter Creek Wilderness, approximately 200 km from the proposed location (east of Apple Grove). Class I areas are federally protected areas for which more stringent air quality standards apply to protect unique natural, cultural, recreational, and/or historic values. The Federal Land Managers (FLM) of these Class I areas have the authority to protect AQRV and to consider, in consultation with the permitting authority, whether a proposed major emitting facility will have an adverse impact on such values. AQRVs for which PSD modeling is typically conducted include visibility and surface deposition of sulfur and nitrogen.

Table 3-1. Class I Q/D Analysis

Class I Area	Distance to Apple Grove	FLAG 2010 Q/D (Apple Grove)¹
Otter Creek Wilderness	220	8.6
Dolly Sods Wilderness	240	7.8
Shenandoah National Park	302	6.2
James River Face Wilderness	318	5.9

¹ Emissions are based on SO₂, NO_x, and PM₁₀ emissions from similar facilities with a scaling factor to represent the proposed mill.

Based on preliminary estimates of project emission increases for pollutants that would be considered in the AQRV analysis, the ratio (Q/D) of the project emissions changes to the distance of the nearest Class I area, is approximately 8.6 for Apple Grove. The new source contributions to the emissions increases are based on the maximum hourly potential emission rates extrapolated to an annual basis assuming continuous operation, and thus, are consistent with FLM guidance for establishing the Q/d ratio based on the maximum daily emission rate extrapolated to an annual basis rather than the annual potential emission rates which may consider inherent constraints on annual production of fuel usage. The FLM’s AQRV Work Group (FLAG) guidance states that a Q/D value of ten (10) or less indicates that AQRV analyses will generally not be required.²⁷ Therefore, it is unlikely the proposed project would lead to adverse impacts at any of the Class I areas listed in Table 3-1. Based on these initial calculations, Nucor presumes that the FLMs for all Class I areas within 300 km of the facility will not require a full AQRV analysis for this project. To confirm this assumption, Nucor will provide the final Q/D analysis and contact the FLMs in consultation with the WVDEP to seek formal concurrence that a Class I area AQRV analysis is not warranted.

In addition to the AQRV analysis, Nucor is required to assess PSD Increment consumption at the affected Class I areas. Nucor proposes to perform this evaluation using a screening methodology that is commonly applied. This methodology relies on the same Significance analysis model input parameters applied for the Class II area assessments. Modeling in AERMOD will be performed by placing an arc of receptors at a

²⁷ National Park Service, U.S. Department of the Interior, Federal Land Managers’ Air Quality Related Values Work Group (FLAG), Phase I Report–Revised (2010), National Resource Report NPS/NRPC/NRR_2010/232, October 2010.

distance of 50 km in the direction each Class I area within 300 km, to demonstrate that impacts are below the Class I SILs. This Class I increment screening procedure was originally proposed by EPA Region 4 and has been used in several recent PSD applications to fulfill the Class I increment modeling requirements. The Class I SILs for the pollutants expected to exceed their respective SERs and for which there is a SIL are presented in Table 3-1. Nucor assumes the PM_{2.5} Class I Area SIL contained in EPA's "Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program" (April 2018) will be accepted for this PSD air quality analysis.

Table 3-1. Class I PSD SILs

Pollutant	Averaging Period	Class I SIL (µg/m³)
NO ₂	1-Hour	NA
	Annual	0.10
PM ₁₀	24-Hour	0.32
	Annual	0.16
PM _{2.5}	24-Hour	0.27
	Annual	0.05
SO ₂	1-Hour	NA
	3-hour	1.00
	24-Hour	0.20
	Annual	0.10

If the impacts within the 50 km arc in the direction of Class I areas exceed the SIL for a particular pollutant/averaging period, Nucor will proceed with full scale long-range transport modeling using EPA's recommended CALPUFF model for that pollutant/averaging period. Based on preliminary Class I Significance Analysis results, Nucor expects modeled concentrations to fall well below the applicable Class SILs, and thus no further refined modeling is expected to be required and a separate Class I modeling protocol for long range transport modeling will not be necessary.

4. ADDITIONAL IMPACTS ANALYSIS

Three additional impacts analyses will be performed as part of the PSD permitting action. These are: 1) a growth analysis, 2) a soil and vegetation analysis, and 3) a visibility analysis.

4.1 Growth Analysis

The purpose of the growth analysis is to quantify project associated growth; that is, to predict how much new growth is likely to occur in order to support the source or modification under review, and then to estimate the air quality impacts from this growth. Accordingly, Nucor will include a discussion of impacts resulting from residential and commercial growth driven by the proposed project in the PSD permit application.

4.2 Soils and Vegetation Analysis

The EPA developed the secondary NAAQS to protect certain air quality related values (i.e., soil and vegetation) that may not be sufficiently protected by the primary NAAQS. The secondary NAAQS, shown in Table 2-1 represent levels that provide protection for public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. As a general rule, if ambient concentrations from a PSD project are found to be less than the secondary NAAQS, emissions from that project will not result in harmful effects to either soil or vegetation.²⁸ Therefore, maximum impacts from the NAAQS analysis will be assessed against applicable secondary standards, to determine impacts to soils, vegetation, and endangered species.

4.3 Visibility Analysis

To provide a demonstration that local visibility impairment will not result from the project, Nucor will utilize the EPA VISCREEN model following the guidelines published in the *Workbook for Plume Visual Impact Screening and Analysis* to assess potential plume impairment.²⁹ The primary variables that affect whether a plume is visible or not at a certain location are (1) quantity of emissions, (2) types of emissions, (3) relative location of source and observer, and (4) the background visibility range. The VISCREEN model is designed to determine whether a plume from a facility may be visible from a given vantage point. Nucor will determine the nearest potentially sensitive Class II areas for consideration in the VISCREEN modeling and include this analysis in the final modeling report. Nucor has determined the nearest potentially sensitive Class II area for consideration in the VISCREEN modeling is Tu-Endie-Wei State Park located about 20 km north of the Apple Grove facility. Level-1 screening techniques are expected to adequately demonstrate plume impairment values below screening thresholds. Regardless, Level-2 and subsequently Level-3 screening techniques will be applied if necessary.

²⁸ U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, New Source Review Workshop Manual, Research Triangle Park, North Carolina, October 1990.

²⁹ EPA, *Workbook for Plume Visual Impact Screening and Analysis*, EPA-450/4-88-015, 1988.

5. OZONE AMBIENT IMPACT ANALYSIS

The latest revisions to the *Guideline*, which was recently published in the Federal Register on January 17, 2017, recommend the use of Model Emissions Rate for Precursors (MERPs)³⁰ to evaluate a proposed project's impact on ozone levels in the surrounding airshed. The *Guideline* establishes a two-tiered demonstration approach for addressing single-source impacts on ozone. Tier 1 demonstrations involve use of technically credible relationships between emissions and ambient impacts based on existing modeling studies deemed sufficient for evaluating a project source's impacts. Tier 2 demonstrations involve case-specific application of chemical transport modeling (e.g., with an Eulerian grid or Lagrangian model). MERPs are a type of Tier 1 demonstration that represent a level of increased precursor emissions that is not expected to contribute to significant levels of ozone. In other words, project emissions are compared against MERP values to determine whether the project emissions would have a significant impact on ozone levels. To derive a MERP value, a model predicted relationship between precursor emissions from hypothetical sources and their downwind maximum impacts is combined with a critical air quality threshold using a predefined equation. Nucor will use pre-established MERPs values based on prior photochemical grid modeling as the primary indicator that the project is not expected to cause or contribute to a violation of the ozone NAAQS.

Initially, Nucor plans to rely upon the lowest MERPs values (most conservative) for the Ohio Valley climate zone from Table 4-1 of EPA's 2019 MERPs guidance. As an alternative, Nucor may use location-specific MERPs from EPA's MERPs Qlik website.³¹ If location-specific MERPs value are used, Nucor will provide additional justification for the specific location and source parameters (i.e., emission rate and release height) chosen for use.

³⁰ *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM_{2.5} under the PSD Permitting Program*, available via:
<https://www.epa.gov/sites/default/files/2019-05/documents/merps2019.pdf>

³¹ <https://www.epa.gov/scram/merps-view-qlik>

6. SECONDARY PM_{2.5} IMPACT ASSESSMENT

PM_{2.5} precursor pollutants (e.g., NO_x, SO₂) can undergo photochemical reactions with ambient gases such as NH₃ or VOC resulting in the formation of secondary PM_{2.5} downwind of a stationary industrial source. The creation of PM_{2.5} by secondary mechanisms increases the total concentration by adding to the direct emissions of PM_{2.5} from a facility. Two of the largest constituents of secondarily-formed PM_{2.5} are sulfates (SO₄) and nitrates (NO₃), both of which are formed from their respective precursor pollutants (SO₂ for SO₄ and NO_x for NO₃).

The current guideline model for Class II Area air dispersion modeling, AERMOD, does not account for many of the complex atmospheric physical and chemical mechanisms that influence PM_{2.5} formation. For example, when run in the regulatory default mode, AERMOD does not account for the size or mass of particulate emissions and, therefore, does not account for the difference in gravitational settling and deposition rates that occur for different particle sizes. No chemical transformation schemes are implemented in AERMOD which could predict secondary PM_{2.5} formation from atmospheric processes.

Based on the MERP guidance offered by EPA, Nucor will prepare a site-specific secondary PM_{2.5} impact assessment to comprehensively demonstrate precursor emissions from the proposed project will not cause or contribute to a violation of the PM_{2.5} NAAQS or PSD increment standards.

Initially, Nucor plans to rely upon the lowest MERPs values (most conservative) for the Ohio Valley climate zone from Table 4-1 of EPA's 2019 MERPs guidance. As an alternative, Nucor may use location-specific MERPs from EPA's MERPs Qlik website.³² If location-specific MERPs value are used, Nucor will provide additional justification for the specific location and source parameters (i.e., emission rate and release height) chosen for use.

³² <https://www.epa.gov/scram/merps-view-qlik>