Guidance on Developing Background Concentrations for Use in Modeling Demonstrations

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1. Introduction

The U.S. Environmental Protection Agency (EPA) is providing this "Guidance on Developing Background Concentrations for Use in Modeling Demonstrations" to fulfill a need for additional guidance on developing a representative background concentration used as part of a cumulative impact analysis for National Ambient Air Quality Standards (NAAQS) implementation modeling demonstrations (*e.g.*, Prevention of Significant Deterioration (PSD) compliance demonstrations, State Implementation Plan (SIP) demonstrations for inert pollutants, and SO_2 designations). Due to the complex nature of determining a representative background concentration, the 2005 and 2017 versions of the *Guideline on Air Quality Models* (U.S. EPA, 2005, 2017; hereafter referred to as the 2005 and 2017 *Guideline*) provided recommendations to appropriately account for the background air quality for a cumulative impact analysis for both isolated single source and multi-source situations. This guidance provides a framework for those undertaking a cumulative impact assessment for NAAQS implementation modeling demonstrations to use in characterizing appropriately representative background concentrations for these situations with an emphasis on identifying what nearby sources to explicitly model. The framework for developing a representative background concentration is primarily applicable to cumulative impact assessment modeling for PSD compliance demonstrations; however, the recommended concepts may be applied in other cumulative modeling exercises such as SIP demonstrations and SO_2 designations.

Section 9.2.3 of the 2017 *Guideline* describes that a cumulative impact analysis may be required in the context of the PSD program if the ambient impacts modeled in the single-source impact analysis indicate that the new or modifying source may cause or contribute to a violation of the NAAQS or PSD increment. In practice, a cumulative impact analysis may be required in

PSD permitting if the ambient impacts of the single-source impact analysis equal or exceed the Significant Impact Level (SIL) for any criteria pollutant or if the permit authority otherwise considers it is necessary to meet the PSD compliance demonstration requirement.[1] In cases where the proposed source or modification's predicted impacts on air quality concentrations are found to be less than the appropriate SIL, the permitting authority may conclude that this is sufficient to show that the increased emissions resulting from construction will not cause or contribute to a modeled violation of the NAAQS and thus not require a full cumulative analysis.[2] However, the permitting authority has discretion to require a full cumulative analysis as necessary to meet the compliance demonstration requirement.

For PSD permitting, a cumulative impact analysis needs to appropriately characterize the spatial nature of air quality near a new or modifying PSD source to identify the potential for NAAQS or PSD increment violations and inform the PSD compliance decisions. Characterization of local air quality around a new or modifying source for each pollutant and averaging period necessitates a full and comprehensive account for all source contributions. A cumulative impact analysis should account for the combined impacts of all direct and precursor emissions of a pollutant from:

- the new or modifying source,
- direct emissions from nearby sources, and

[1] As stated in the 2018 Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program, "[t]he EPA has historically used pollutant-specific concentration levels known as 'significant impact levels' to identify the degree of air quality impact that 'causes or contributes to' a violation of a NAAQS or PSD increment."
[2] 1990 Draft NSR Workshop Manual at C.51-C.52

- monitored background concentrations accounting for primary and/or secondary impacts from regional background sources and nearby sources not explicitly modeled[3].

Appropriately accounting for all source contributions is an inherently discretionary exercise with use of best professional judgment in determining a representative background concentration and identifying nearby sources that need to be explicitly modeled.

Section 8 of the 2017 *Guideline* provides recommendations on how to identify and characterize nearby sources in modeling as part of a cumulative impact analysis for NAAQS compliance demonstrations and PSD permitting. Section 8.3 defines what nearby sources should be included and thus explicitly modeled in a cumulative impact analysis, while section 8.2.2 and Table 8-2 provide information on how nearby sources should be modeled. One primary focus of this guidance is on the process for identifying nearby sources in multi-source areas to determine an appropriately representative background concentration and the potential for modeled NAAQS or PSD increment violations in assessing whether a new or modifying source may cause or contribute to such violations. Recommendations made in both the 2005 and 2017 versions of the *Guideline* highlight the importance of the use of professional judgment in this process.

Section 8.2.3 of the 2005 *Guideline* recommended that in multi-source areas "all sources expected to cause a significant concentration gradient in the vicinity of the source or sources under consideration for emission limit(s) should be explicitly modeled. The number of such sources is expected to be small except in unusual situations" (U.S. EPA, 2005). The 2005 *Guideline* went on to recommend the exercise of professional judgment to identify nearby sources because no attempt was made to comprehensively define the term significant concentration gradient.

[3] For a more detailed explanation of sources that should be accounted for in a cumulative impact analysis, please see section II.5.1 of the Guidance for Ozone and Fine Particulate Matter Permit Modeling (U.S. EPA, 2022)

The 2017 revisions to the Background Concentration section (section 8.3) of the *Guideline* built upon the recommendations made in the 2005 *Guideline* by providing additional considerations emphasizing the use of significant concentration gradients to determine which nearby sources to explicitly model and the use of monitored background to adequately represent other sources. Section 8.3.3.a of the 2017 *Guideline* states that "[i]n multi-source areas, determining the appropriate background concentration involves: (1) Identification and characterization of contributions from nearby sources through explicit modeling, and (2) characterization of contributions from other sources through adequately representative ambient monitoring data." In practice, the interconnectedness of these two components tends to be overlooked and determining the nearby sources to explicitly model using a significant concentration gradient analysis has proven to be problematic given the lack of clear definition of that term by EPA and concrete examples of applying it in modeling demonstrations.

Thus, rather than continued reliance on the concept of significant concentration gradient, this guidance provides a recommended framework that starts with a determination of the representativeness of the ambient monitoring data and then uses readily available data to inform the determination of those nearby sources to explicitly model to best characterize local air quality and to address the potential NAAQS or PSD increment violations as part of a cumulative impact analysis. EPA developed this recommended framework based on the underlying recommendations in the 2005 and 2017 versions of the *Guideline.* This document provides additional clarification to assist the permitting authority's and permit applicant's appropriate application of the inherent discretion under the *Guideline*. The framework outlines several qualitative and quantitative considerations for both isolated-single source and multi-source scenarios that are consistent with the recommendations made in section 8.3 of the 2024 revisions of the *Guideline on Air Quality Models* (U.S. EPA, 2024; hereafter referred to as the 2024 *Guideline*).[4] Applying this framework may assist permit applicants in identifying and documenting the determination of nearby sources to be explicitly modeled as part of a cumulative impact analysis and thereby improve their ability to adequately represent the local air quality near the source(s) under consideration. The analyses performed while applying this framework should be documented in the modeling protocol and permit record to justify the applicable NAAQS and PSD determinations. This document presents recommended procedures to those conducting a cumulative impact analysis to follow in developing an appropriate representation of local air quality for sources under consideration for PSD and SIP compliance demonstrations (inert pollutants) and SO_2 designations. The approach recommended in this document should not be followed by those conducting SIP attainment demonstrations for ozone, $PM_{2.5}$, and regional haze[5] since the emissions from nearby and other sources are included as inputs in the photochemical grid modeling and are fully accounted for in the predicted concentrations (2017 *Guideline*, section 8.3.1(c)).

This document is not a rule or regulation, and the guidance it contains may not apply to a particular situation depending upon the individual facts and circumstances germane to the unique objectives of the modeling demonstration. This guidance does not change or substitute for any law, regulation, or any other legally binding requirement, may refer to regulatory provisions without repeating them in their entirety, and is not legally enforceable. The use of non-mandatory language such as “guidance”, “recommend”, “may”, “should”, and “can”, is intended to describe EPA policies and recommendations. Mandatory terminology such as “must” and

[4] https://www.epa.gov/scram/2024-appendix-w-final-rule

[5] For more information on SIP attainment demonstrations for ozone, $PM_{2.5}$, and regional haze please refer to the *Modeling Guidance for Demonstrating Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze* (EPA 454/R-18-009).

“required” are used when describing requirements under the terms of the CAA and EPA regulations. This document does not establish or alter any legally binding requirements in and of itself.

This guidance does not create any rights or obligations enforceable by any party or impose binding, enforceable requirements. Since each regulatory action (*e.g.*, PSD permit, SIP revision, etc.) will be considered on a case-by-case basis, this document does not limit or restrict any justifiable approach that regulatory applications and authorities may take to conduct the required compliance demonstrations. Each individual PSD permitting decision must be supported by a record sufficient to demonstrate that the action will not cause or contribute to a violation of the applicable NAAQS and PSD increment. Likewise, SIP determinations and SO_2 designations should be supported by the record in these actions. While this document illustrates a framework approach that EPA considers appropriate and acceptable as a general matter, all relevant information regarding air quality in the area of the regulatory action should be examined to determine whether alternative or additional analysis may be necessary in a given case to demonstrate that the appropriate regulatory criteria are satisfied. This document does not represent a conclusion or judgment by EPA that the technical approaches recommended in this document will be sufficient to make a successful compliance demonstration in every PSD permitting decision or to meet the applicable requirements in other contexts.

Regulatory authorities retain the discretion to address particular issues discussed in this document in a different manner than EPA recommends so long as the approach is adequately justified, supported by the record and relevant technical literature, and consistent with the applicable requirements in the CAA and implementing regulations, including the terms of an approved State Implementation Plan (SIP) or Tribal Implementation Plan (TIP). Furthermore, this guidance is not a final agency action and does not determine applicable legal requirements or the approvability of any particular regulatory application.

2. Guidance Overview

This guidance is appropriate for proposed new, modifying, or existing sources performing a cumulative impact analysis as part of a NAAQS implementation modeling demonstration (e.g., PSD compliance demonstrations, SIP demonstrations for inert pollutants, and SO_2 designations). It provides an EPA recommended framework with a logical progression of steps to identify a representative background concentration for the cumulative impact analysis in situations with an isolated single source (see section 3) and multi-source areas (see section 4). Since each modeling demonstration is considered on a case-by-case basis, this guidance does not limit or restrict any justifiable approach that the modeler and reviewing authority may take to conduct the required demonstrations. Those conducting NAAQS implementation modeling should recognize the importance of the consultation process with the appropriate reviewing authority. This process will help the permit applicant and state or tribal air agency best work within the EPA's recommended framework and apply the most appropriate qualitative and quantitative considerations to characterize an adequately representative background concentration for PSD cumulative impact analyses or related applications.

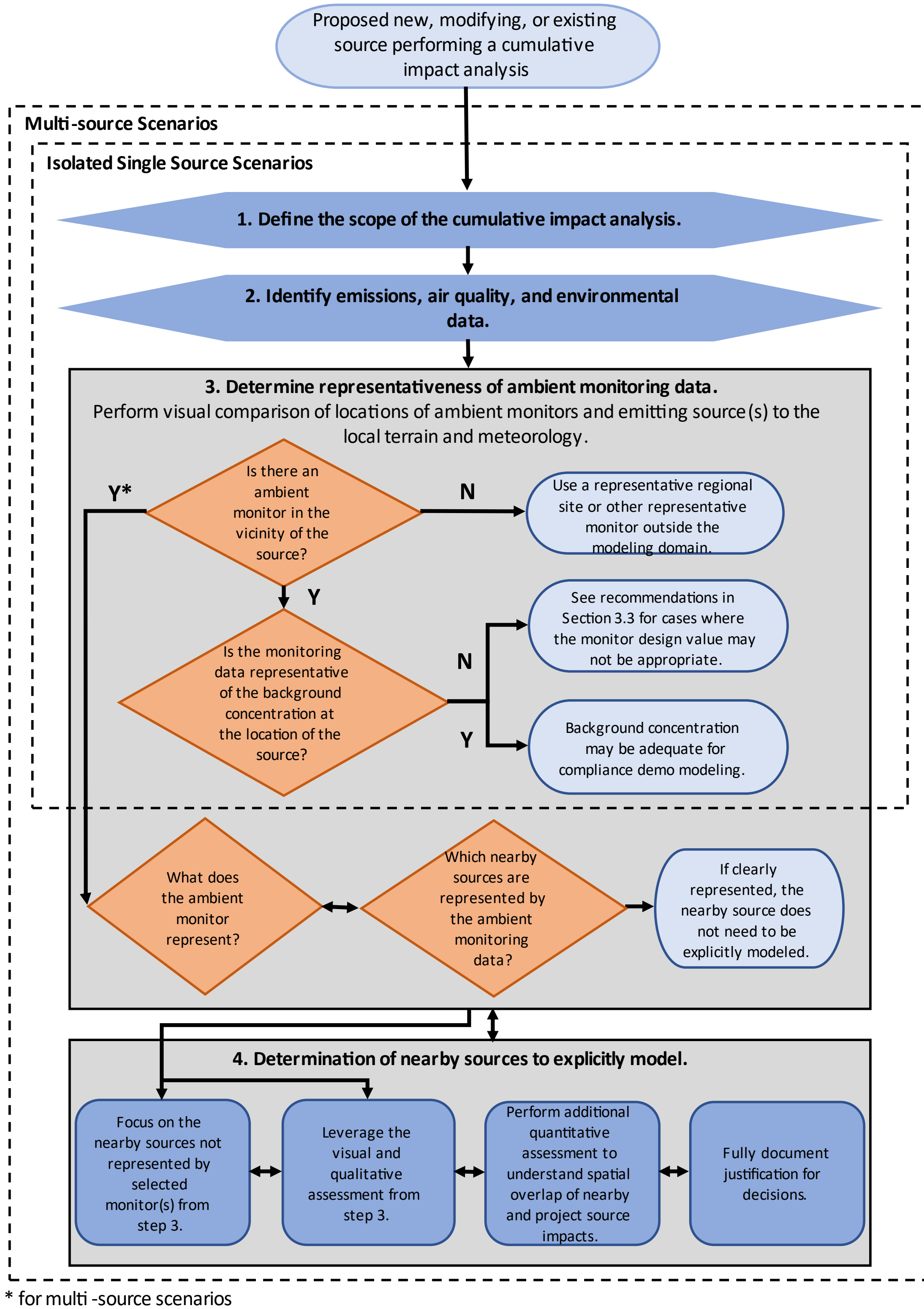
2.1 Determining a Representative Background Concentration

Section 8.3 of the 2017 *Guideline* states that, "Background concentrations are essential in constructing the design concentration, or total air quality concentration, as part of a cumulative impact analysis for NAAQS and PSD increment (section 9.2.3). Background air quality should not include the ambient impacts of the source(s) under consideration." Instead, it should include nearby sources, which may or may not be adequately represented by the ambient monitoring data. Background air quality should also include other sources such as natural sources, other unidentified sources (*e.g.*, decommissioned, new or modifying minor and major sources), and local transportation sources. To appropriately characterize background concentrations for cumulative impact assessments, as defined in the 2024 *Guideline*, EPA is recommending a framework composed of the following steps:

1. Define scope of cumulative impact analysis for isolated or multi-source situations
2. Identify relevant and available emissions, air quality and environmental data
3. Determine representativeness of ambient monitoring data
4. Determine nearby sources to be explicitly modeled

This framework will facilitate applying best professional judgment to identify appropriately representative monitoring data and select nearby sources to explicitly model to inform a cumulative impact analysis that best represents the local air quality throughout the geographic scope of the analysis in particular near the source(s) under consideration.

Figure 1. EPA Recommended Framework for Characterizing Representative Background Concentrations for Cumulative Impact Assessments in Modeling Demonstrations



2.2 Framework for Identifying a Representative Background Concentration

This section discusses each step of the framework as applied to isolated and multi-source scenarios and as applicable to each pollutant and averaging period being evaluated. As indicated in Figure 1, the first three steps of the framework are applicable to a source located in an isolated location. For a multi-source area, the first three steps are then followed by the fourth step to determine the nearby sources to explicitly model. The details and data considerations underlying each step of the framework relies heavily upon the expert judgment to work through each step and conduct a cumulative impact analysis that best characterizes local air quality and, for PSD permitting, inform determination of whether or not the source(s) under consideration will cause or contribute to a NAAQS or PSD increment violation. During the application of the framework, the scope of the cumulative assessment may change from an isolated source situation to a multi-source situation or vice versa if new permitting or modeling data is discovered or made available. If this occurs, each step of the framework should be reconsidered given the new scope of the cumulative impact assessment.

Under the EPA recommended framework, the characterization of background concentrations as part of the cumulative impact analysis for each pollutant should be developed according to the following steps:

1) Define scope of the cumulative impact analysis for isolated or multi-source situations.

This step involves defining and documenting the following factors[6]:

   a) Source(s) under consideration location relative to other sources/facilities (i.e., to define as an isolated or multi-source area)

[6] For more information on important aspects of PSD compliance demonstrations for NAAQS and PSD increment, please refer to EPA's Air Quality Analysis Checklist (U.S. EPA, 2016).

i) The location of the source(s) under consideration should be mapped alongside other known sources or facilities in the area to determine whether the source(s) under consideration is an isolated source or located in a multi-source area. Emissions inventory lists made available by the state may be referenced to create an initial account of emitting sources within the modeling domain. In cases where the source(s) under consideration is undergoing modification, nearby sources should include parts of the existing facility that are not affected in the modification.

b) Applicable NAAQS pollutants and averaging periods

i) The averaging period for the NAAQS pollutant should be considered when estimating the spatial extent of the emitted plume from the project or nearby sources. The dispersion of an emitted plume will differ for short term vs. annual standards and will therefore influence whether a monitor may be representative of impacts from those emitting sources.

c) Scope of geographic area (i.e., modeling domain)

i) In situations where a single-source impact analysis is available, the 2024 *Guideline* defines the modeling domain as "the most distant location where air quality modeling predicts a significant ambient impact will occur" but this area is not to exceed 50 km from the proposed new or modifying source.

ii) In situations where a single-source impact analysis is not available and the reviewing authority requests a cumulative impact analysis, the 2024 *Guideline* defines the modeling domain to include "the nominal 50 km distance considered applicable for Gaussian dispersion models[.]"

d) Dispersion environment (e.g., meteorology, terrain, land/water surface characteristics, urban or rural dispersion assumptions, etc.)

2) Identify relevant and available emissions, air quality, and environmental data.

This step involves identifying and gathering the relevant and available emissions, monitoring, and modeling data including but not limited to the following[7]:

a) Ambient monitoring data located within the modeling domain of the source(s) under consideration and/or surrounding areas (e.g., ambient monitoring data from state and local agency's ambient air monitoring networks, pre- or post-construction monitoring from the project or any nearby sources, or an EPA ambient air monitoring network)
b) Permit action or previous dispersion modeling for the source(s) under consideration (e.g., the single source impact analysis)
c) Pre-existing dispersion modeling for potential nearby sources (e.g., from previous demonstrations or for similarly situated sources)
d) Any other relevant emissions and air quality data:
    i) Annual emissions data for potential nearby sources
    ii) Active or pending PSD or minor source construction permits or applications for potential nearby sources
    iii) Active or pending minor modification permit applications
    iv) Title V, minor source operating permits and other state-only issued permits for potential nearby sources

[7] More information on where to retrieve relevant emissions, air quality, and environmental data can be found in Appendix A of this document.

e) Environmental data for the modeling domain and/or surrounding area that might influence dispersion and transport of source plumes:

   i) Meteorology (wind direction and speed)

   ii) Terrain (flat, complex, particular terrain features)

   iii) Land/water surface characteristics

These data will serve as the basis to inform the next two steps in determining representativeness of the ambient monitoring data and determining what nearby sources, if any, to explicitly model.[8]

3) Determine representativeness of ambient monitoring data

The key to determining the representativeness of available ambient air quality data is to consider the "extent to which ambient air impacts of emissions from [the project and] nearby sources are reflected in the available ambient measurements, and the degree to which emissions from those background sources during the monitoring period are representative of allowable emission levels under the existing permits" (U.S. EPA, 2010). This step involves determining what "source mix" the ambient monitor data represent, i.e., source contributions to pollutant concentrations, and how the monitor(s) may or may not represent the source mix near the source(s) under consideration or modeling domain. A spatial map should be created of the available monitor data and the location of known sources to visually and qualitatively compare the mix of emitting sources and the dispersion environment (i.e., terrain and wind rose data). The following factors should be considered when determining which ambient monitor data are representative of the air quality around the source(s) under consideration:

[8] There are a number of tools that are commonly used to visualize the location of the applicable data elements described in this section. Google Earth can be used to evaluate land use throughout the modeling domain, identify terrain features, as well as map out the locations of sources, weather stations and monitors. ESRI ArcGIS may be used to plot terrain data from the USGS National Map and the NLCD land cover data from the MRLC.

a) The averaging time of the applicable NAAQS with regards to determining whether a monitor captures emissions from the source(s) under consideration or nearby sources during the applicable averaging time.
b) The measurement scale (e.g., neighborhood, urban, regional scale, etc.) and monitoring objective (e.g., source oriented, population exposure, background, highest concentration, etc.) of each individual monitor[9]
c) The mixture of emitting source(s) (e.g., permitted sources, roadway emissions, natural sources, other unpermitted sources, etc.) and their magnitude of emissions and release height (i.e., elevated stacks or ground level releases)
d) Dispersion environment (e.g., meteorology, terrain, land/water surface characteristics, urban or rural dispersion assumptions, etc.)

The approach for making this determination should differ depending on whether it is an isolated source or multi-source situation. However, it should rely on the same underlying data and principles of performing a spatial comparison of the source(s) under consideration and monitoring site location.

For isolated single sources, the cumulative impact analysis should rely largely, if not solely, on the available monitoring data to fully characterize the background concentrations near the source(s) under consideration. For these situations, a visual and qualitative assessment of the dispersion environment (e.g., the terrain and wind patterns) at the location of the ambient monitors should be performed to determine whether the ambient air at the location of the monitor

[9] EPA provides an up-to-date monitor list of all monitors with data available in the AQS system. This list details the "measurement scale" and "monitoring objective" for each AQS monitor when available. This information should be used to inform the selection of a representative monitor. Monitors may be classified as micro-scale (0 m to 100 m), middle scale (100 m to 500 m), neighborhood scale (500 m to 4 km), urban scale (4 km to 50 km), and regional scale (50 km to hundreds of km). The link to this list can be found at: https://aqs.epa.gov/aqsweb/airdata/download_files.html

is representative of the ambient air in the project area. The selected representative monitor should have terrain features and wind patterns similar to the project area, and represent pollutant transport into the modeling domain, i.e., background contributions from other sources. The representative monitor may not be the closest in proximity to the source(s) under consideration or even be located within the modeling domain. In situations where the monitored design value is not representative of the background concentration and/or the design value is overly biased due to impacts from the project and existing sources, one can consider modifying the design value data or using modeled estimates to best characterize background air quality levels in consultation with the appropriate reviewing authority.[10, 11] Further refinements to modeled estimates paired with design concentrations may be made based on model options controlling for downwind and upwind sectors.

For multi-source areas, the cumulative impact analysis should rely upon selected monitoring data as supplemented by explicit modeling of nearby sources, as appropriate, to fully characterize the background concentrations near the source(s) under consideration. For these situations, a visual and qualitative assessment of the ambient monitor locations should be performed to understand what they represent in terms of source mix. Similar to the isolated source situation, the dispersion environment at the locations of the monitor site(s) and the source(s) under consideration should be compared along with the emitting source locations and magnitude of emissions to understand the extent to which the ambient monitor may account for the impacts of these emitting sources. In addition to the area surrounding the source(s) under

[10] The flexibility to modify the design value data is afforded under 40 CFR Part 51, Appendix W, Section 8.3.2(c).

[11] For additional information on design value modification beyond exceptional events, refer to the 2019 Memorandum on Additional Methods, Determinations, and Analyses to Modify Air Quality Data Beyond Exceptional Events. https://www.epa.gov/sites/default/files/2019-04/documents/clarification_memo_on_data_modification_methods.pdf

consideration, one should also focus on any areas where the single source impact analysis of the source(s) under consideration, if available[12], indicates modeled exceedances of the SIL because nearby source contributions will be important in these areas to appropriately represent local air quality in such areas and the potential for NAAQS or PSD increment violations.

4) Determine nearby sources to be explicitly modeled.

This step is applicable to multi-source areas and involves determination of nearby sources to explicitly model in conjunction with the selected monitoring data to appropriately characterize the background concentration for the cumulative impact analysis. As noted in the *Guideline*, this step is interconnected to the selection of representative monitoring data since the sources deemed to be represented by the monitoring data in step 3 will help determine which sources should be explicitly modeled since they are not accounted for in the monitored background concentration. When determining what nearby sources to explicitly model, one should consider the following factors:

a) The averaging time of the applicable NAAQS, i.e., spatial extent of the source impacts per plume travel time.

b) The measurement scale (e.g., neighborhood, urban, regional scale, etc.) and monitoring objective (e.g., source oriented, population exposure, background, highest concentration, etc.) of the selected monitor(s).

c) The mixture of emitting source(s) and their magnitude of emissions and release height (i.e., elevated stacks or ground level releases) at the selected monitoring site, near the

[12] Throughout this draft guidance, EPA will recommend using results from a single source impact analysis "if available". In PSD permitting cases, there may be scenarios where the permit authority requests that the permit applicant skip performing a single source impact analysis first and move straight to performing a cumulative impact assessment.

source(s) under consideration, and areas that the source(s) under consideration's modeling shows impacts above the SIL.

d) Permit action or previous dispersion modeling for the source(s) under consideration (e.g., single source impact analysis).

e) Pre-existing dispersion modeling for potential nearby sources (e.g., from previous permit actions or for similar type sources).

f) Dispersion environment (e.g., meteorology, terrain, land/water surface characteristics, etc.) at the selected monitoring site and source(s) under consideration.

Basically, to determine which nearby sources are not adequately accounted for by the selected monitoring data, one needs to consider, if known, the nature of sources near the source(s) under consideration as well as the areas within modeling domain where the source(s) under consideration has impacts equal to or above the relevant SIL that a permitting authority chooses to use. If a nearby source is not adequately accounted for by the selected monitoring data, then one should consider explicitly modeling those nearby sources to fully characterize air quality impacts and best account for potential NAAQS or PSD increment violations.

3. Application of Framework in Isolated Single Source Scenarios

Section 8.3.2 of the 2024 *Guideline* makes recommendations for isolated single source situations and provides the context, specificity, and flexibility sufficient to determine total air quality concentrations for modeling domains where only contributions from the source(s) under consideration and representative ambient monitoring data are necessary and deemed sufficient. Nearby or neighboring emission sources should not be considered under these isolated-source scenarios. The relative isolation of a particular source should be based on professional judgment, and the pollutant species and averaging period being assessed. In some scenarios, a source that is initially considered to be isolated may be reconsidered as a multi-source situation when assessing the locations of point sources in the source inventory. The flow-chart presented in Figure 1 therefore emphasizes the first three steps of the EPA recommended framework to determine representative ambient monitoring data as relevant for isolated source scenarios. A hypothetical example of applying the framework in three isolated single source scenarios is provided in Appendix B.

3.1 Defining the Scope of the Cumulative Impact Analysis

The first step is to develop an overall understanding of the source(s) under consideration and surrounding area that should be accounted for in the cumulative impact assessment. An isolated source will tend to be a proposed source or modification that will be constructed in an area that is generally free from the impact of other point sources and area sources associated with human activity (U.S. EPA, 1987). As a result, air quality levels in such areas should be appropriately characterized by ambient monitoring data to represent background concentrations. The location of the isolated source should be mapped within the modeling domain alongside the relevant factors provided in section 2.2 that are gathered in step 2 with an emphasis on the monitoring data within the modeling domain. As stated earlier, in terms of geographic scope of the cumulative impact analysis, in situations where a single-source impact analysis is available, the 2017 *Guideline* defines the modeling domain as “the most distant location where air quality modeling predicts a significant ambient impact will occur” but this area is not to exceed 50 km from the proposed new or modifying source. When a single-source impact analysis for the source under consideration is not available and the reviewing authority requests a cumulative impact analysis, the 2017 *Guideline* defines the modeling domain to include “the nominal 50 km distance considered applicable for Gaussian dispersion models[.]” In cases where it is unclear whether the proposed source should be considered isolated, it may be necessary to use information from Step 2 to make the determination. It may be the case that proximity alone is not sufficient to determine if the proposed source is in an isolated or multi-source area. For these unique cases, emissions, and source characteristics for the identified nearby source(s) such as emission rate and stack height may be helpful in making a determination.

3.2 Identifying Relevant and Available Emissions, Air Quality and Environmental Data

For areas with an isolated source(s), section 8.3.2(a) of the 2024 *Guideline* states that " . . . determining the appropriate background concentration should focus on characterization of contributions from all other sources through adequately representative ambient monitoring data." So, the emphasis for isolated source situations is on the ambient monitoring data along with environmental data for the modeling domain and surrounding areas that will inform the next step of determining representative background concentrations based on the appropriate ambient monitoring data.

3.3 Determining Representativeness of Ambient Monitoring Data

Section 8.3.2(b) of the 2024 *Guideline* provides EPA's recommendations for selecting representative ambient monitoring data to characterize the total air quality near an isolated single source. EPA recommends selecting "the most recent quality assured air quality monitoring data collected in the vicinity of the source to determine the background concentration for the averaging times of concern". The ambient monitoring data may come from a number of sources such as a state and local ambient air monitoring network, an EPA ambient monitoring network, or any pre- or post-construction monitoring data that may be available. The selected ambient monitoring data should be current (e.g., measured in the three most recent years of data similar to those years used in the design value calculation or otherwise representative of current conditions) and meet EPA's recommended methods for data collection and processing[13] in addition to the quality assurance, and quality control requirements[14]. EPA recognizes that the identification and determination of representativeness of ambient monitoring data may be an iterative process when all air quality data relevant to the modeling domain is assessed.

The cumulative impact assessment for isolated sources largely relies on the "characterization of contributions from all other sources through adequately representative ambient monitoring data," as stated in the 2024 *Guideline*. To identify whether there is ambient monitoring data in the vicinity of the source, EPA recommends visually and qualitatively assessing the modeling domain and its available characteristics (e.g., monitor locations and scales, terrain features, wind rose data, etc.). In cases where there are one or more monitors within the vicinity of the project area, one should exercise the use of professional judgment to determine whether the selected monitor is representative of the background concentration in the project area. EPA generally recommends using data from the closest upwind monitor to the project; however, one needs to assess the representativeness of the monitor location and not solely choose based on proximity. Data on the location (i.e., urban vs. rural), wind patterns, and terrain features at both the monitor and the source under consideration may be used to inform the selection of representative background concentration data. Any meteorological data used to identify an upwind monitor should be representative[15] of the area near the monitor and the nearby source(s) affecting the monitor. Monitoring sites may have co-located wind field

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[13] For PSD compliance demonstrations, the collection and processing of the ambient air data should follow the recommendations of the *Ambient Monitoring Guidelines for Prevention of Significant Deterioration* (EPA-450/4-87-007).

[14] The quality assurance and quality control methods for the selected ambient monitor should be consistent with the EPA's *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II – Ambient Air Quality Monitoring Program* (EPA-454/B-13-003).

[15] Additional information regarding determining representativeness of meteorological data can be found in EPA's *Meteorological Monitoring Guidance for Regulatory Modeling Applications* (EPA-454/R-99-005).

measurements; however, these measurements may not have undergone proper QA/QC to be suitable for this type of analysis.

The following questions should be considered when determining what the ambient monitor represents and how that may differ from the background air quality in the project area:

- Is the monitor located in an urban or rural setting similar to the project area?
- Are the wind and terrain patterns at the monitor consistent with the project area?
- Is the monitor representative of pollutant transport from other sources located outside of the modeling domain?
- Has ambient data from this monitor been used in previous cumulative impact analysis for the project area or surrounding areas?

In addition to these questions, one should keep in mind that the proximity of a monitor to the source under consideration is not inherently linked to how representative that monitor may be of the background concentration in the project area. Therefore, it is critical to understand what the ambient monitor may be representing and how the dispersion environment around the monitor is similar to or differs from that of the project area. For isolated source locations, it is important to note the extent to which the monitor location in closest proximity to the project area differs from the project area, i.e., whether the monitor location is influenced by nearby source emissions outside of the project area, whether the monitor is in an urban area when the project is in a rural area or vice versa, or where the monitor is located in a different type of terrain from the project area, such as complex terrain or flat terrain. In such cases where the closest monitor(s) are not representative of the background concentration in the project area, it may be appropriate to identify monitors outside of the modeling domain. Any ambient monitor may be selected if there is reasonable evidence as to why the selected monitor is most representative of the background concentration in the project area. If there are no monitors within the vicinity of the source, the 2024 *Guideline* recommends that a regional site[16,17] monitor be used to determine background concentrations. Alternatively, as listed in section 2(a) any pre-construction monitoring data that may be available for the source(s) under consideration may be considered as the ambient background monitor if the data is still representative of the project area. Finally, section 8.3.2(f) of the 2024 *Guideline* recommends that "it may be appropriate to use results from a regional-scale photochemical grid model, or other representative model application" in consultation with the appropriate reviewing authority.[18]

When determining an appropriate background concentration to be used in conjunction with the dispersion modeling for the cumulative impact analysis, it is important to consider how the monitor-based background contribution will be combined with the modeled impact from the project and other sources to represent the design concentration, or total air quality concentration. Section 8.2.3(c) of the 2024 *Guideline* outlines several options that are available for the reviewing authority to consider. EPA recommends starting with the current design value from the selected monitor for the applicable NAAQS as a uniform monitored background contribution across the project area. However, given the case-by-case nature of this practice, the uniform background contribution may not be appropriate in all cases, and it may be necessary to modify the ambient data record in consultation with the appropriate reviewing authority. These cases may include but are not limited to the following scenarios:

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[16] The 2024 *Guideline* defines a regional site as "one that is located away from the area of interest but is impacted by similar or adequately representative sources."

[17] The 1987 Ambient Monitoring Guidelines for PSD states "If the proposed source or modification will be constructed in an area that is generally free from the impact of other point sources and in an area that is generally free from the impact of other point sources and area sources associated with human activities, then monitoring data from a "regional" site may be used as representative data" (EPA-450/4-87-007).

[18] Guidance on recommendations for photochemical modeling for ozone and $PM_{2.5}$ can be found in the EPA's *Modeling Guidance for Demonstrating Air Quality Goals for Ozone,* $PM_{2.5}$ *and Regional Haze* (EPA 454/R-18-009), and the *Guidance for Ozone and Fine Particulate Matter Permit Modeling* (EPA-454/R-22-005).

- Under PSD permitting, if the source under consideration is a modification where the existing facility's emissions affect the ambient monitor(s), monitored values may be excluded from the design value calculation when the existing source is affecting the monitor. To identify values to exclude, one should first determine the area of impact for the existing source by comparing emissions information to the monitoring sites within a 90-degree sector downwind of the source in question. The existing source's emissions should then be paired with hourly wind rose data to identify specific hours the existing source is affecting the monitor.[19] Careful consideration should be taken to ensure that the existing source impacting the monitor is operating during the hours in which the monitored values are excluded from the design value calculation. Finally, the use of pollution roses overlaid on spatial maps of the project area may help diagnose contributions from upwind sectors to isolate regional background from the existing facility's contributions.
- Data may also be modified or excluded from the ambient data record when the monitor is impacted by atypical activities[20] (i.e., impacts that will not occur again in the future). Examples of this may include but are not limited to construction, roadway repairs, forest fires, or unusual agricultural activities. In these cases, one should determine whether it is appropriate to scale the monitored concentrations by a factor, adjust the data by adding or subtracting a constant value from the monitored concentrations, or omit the specific hours or days of the atypical activity all together. The newly modified concentrations should be

[19] In circumstances where there is not a representative meteorological station near the source-impacted monitor, EPA recommends the use of prognostic meteorological data (i.e., from the Weather Research and Forecasting, WRF model) or the use of a trajectory model to remove hours in which the source is impacting the background monitor.
[20] For more information on modifying ambient data please refer to EPA's guidance on *Additional Methods, Determinations, and Analyses to Modify Air Quality Data Beyond Exceptional Events* (EPA-457/B-19-002).

compared against a historical record of ambient data from the monitor to determine whether "such adjustments would make the monitored background concentrations more temporally and/or spatially representative of the area around the [source(s) under consideration] for the purposes of the regulatory assessment" (U.S. EPA, 2024a).

- For demonstrations regarding short-term standards, the diurnal or seasonal patterns captured in the air quality monitoring data may differ significantly from the diurnal or seasonal patterns used to estimate modeled concentrations. When this occurs, one should pair the air quality monitoring data in a temporal manner that reflects these patterns and follows the recommendations provided for the specific standard.[21]
- When multiple monitors are present in the project area and monitored air quality concentrations appear to vary across the modeling domain, it may be appropriate to use data from multiple monitors within the project area. The manner in which data from multiple monitors may be analyzed and considered in the background concentration is a case-by-case determination based on factors unique to the project area.[22]

These options provide flexibility to relieve challenges that may arise when combining the monitor-based background contribution with the modeled impacts from the source(s) under consideration and allows for the consideration of spatial and temporal variability throughout the modeling domain. However, given that these variabilities can occur on an hourly basis and the

[21] The guidance on *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Standard* recommends "that an appropriate methodology for incorporating background concentrations in the cumulative impact assessment for the 1-hour NO_2 standard would be to use multiyear averages of the 98^{th} percentile of the available background concentrations by season and hour-of-day, excluding periods when the source in question is expected to impact the monitored concentration (which is only relevant for modified sources)." The 99^{th}-percentile should be used for the 1-hour SO_2 standard.

[22] For cases where multiple ambient monitors are located outside of the modeling domain, AERMOD allows for sector-varying background concentrations through the BGSECTOR keyword. This keyword allows users to define sectors where background concentration from the selected upwind monitor will be applied to the entire modeling domain (i.e., all receptors) during times that the wind is blowing from that direction. (U.S. EPA, 2024b)

possible limitations of hourly observations from the ambient monitoring network, "the EPA does not recommend hourly or daily pairing of monitored background and modeled concentrations except in rare cases of relatively isolated sources where the available monitor can be shown to be representative of the ambient concentration levels in the areas of maximum impact from the proposed new source" (U.S. EPA, 2024a). Hour-by-hour pairing is not recommended because this approach assumes that the hourly monitored background concentration is spatially uniform for the hour and that the monitored values are representative of background levels at each receptor. In the 2024 *Guideline*, EPA recommends the use of seasonal or quarterly pairing of monitored and modeled concentrations as that should sufficiently capture situations where the modeled emissions are not temporally correlated with background monitored levels.

4. Application of Framework in Multi-source Areas

Section 8.3.3 of the 2024 *Guideline* makes recommendations for multi-source areas and provides the context, specificity, and flexibility sufficient to determine total air quality concentrations for modeling domains that are adequately predicted by contributions from the source(s) under consideration, representative ambient monitoring data, and the explicit modeling of a few nearby sources. The determination of which nearby sources, if any, that will be explicitly modeled to fully characterize background air quality in a multi-source situation should be based on professional judgment consistent with EPA's framework, and the pollutant species and averaging period being assessed. As highlighted in Section 8.3.3 of the 2024 *Guideline*, "[a] key point here is the interconnectedness of each component in that the question of which nearby sources to include in the cumulative modeling is inextricably linked to the question of what the ambient monitoring data represents within the project area." The flow-chart presented in Figure 1 adds this additional fourth step of "Determination of Nearby Sources to Explicitly Model" relevant to multi-source areas in applying the EPA recommended framework. Appendix C provides an example of applying this framework to a hypothetical multi-source example.

4.1 Defining the Scope of the Cumulative Impact Analysis

The goal of step 1 is to develop an overall understanding of the source(s) under consideration and surrounding area that should be accounted for in the cumulative impact assessment. The location of the source(s) under consideration should be mapped within the modeling domain alongside the relevant factors provided in section 2.2 that are gathered in step 2 with an emphasis on emission sources within the modeling domain in proximity to the source(s) under consideration source and monitoring locations. As stated earlier, in terms of geographic scope of the cumulative impact analysis, in situations where a single-source impact analysis is available, the 2024 *Guideline* defines the modeling domain as “the most distant location where air quality modeling predicts a significant ambient impact will occur” but this area is not to exceed 50 km from the proposed new or modifying source. When a single-source impact analysis for the source(s) under consideration is not available and the reviewing authority requests a cumulative impact analysis, the 2024 *Guideline* defines the modeling domain to include “the nominal 50 km distance considered applicable for Gaussian dispersion models[.]”

4.2 Identifying Relevant and Available Emissions, Air Quality and Environmental Data

For areas with multiple source(s), section 8.3.3(a) of the 2024 *Guideline* states that "[…] determining the appropriate background concentration involves: (1) Identification and characterization of contributions from nearby sources through explicit modeling, and (2) characterization of contributions from other sources through adequately representative ambient monitoring data.” So, the emphasis for multi-source situations should be on the emissions data, existing modeling for emitting sources and ambient monitoring data along with environmental data for the modeling domain and surrounding areas that will inform the next two steps of determining representative background concentrations and what nearby sources to explicitly model.

In multi-source situations, the added focus should be on gathering the relevant data related to characterizing potential nearby sources in the areas near the monitor locations, source(s) under consideration, and areas for which the source(s) under consideration has modeled impacts above the SIL, if known. These data should include the location, release height, emissions rates, and any other available emissions data or observed meteorological data. The emissions data used for further analysis should be representative of "normal" operating conditions at the nearby source. A survey of multiple years of emissions data may be necessary to identify any years of data that may not be representative of "normal" operating condition for the source. For PSD modeling demonstrations, the emissions data generally is available from the applicable operating permits. In addition, a PSD permit applicant should be aware of any of the following that may be present in the project area:

- Active or pending PSD or minor source construction permits or applications
- Active or pending minor modification permit applications
- Title V, minor source operating permits, and any other state-only issued permits for potential nearby sources

Documentation on these permit applications can usually be obtained through the applicable state environmental agency's permitting website. Appendix A provides a more comprehensive list of the emissions, air quality, and environmental data to consider when determining an appropriate background concentration.

4.3 Determining Representativeness of Ambient Monitor Data

As highlighted in the 2024 *Guideline*, for the source(s) under consideration located in a multi-source area, there is an interconnectedness between this step and the next step in that "the question of which nearby sources to include in the cumulative modeling is inextricably linked to the question of what the ambient monitoring data represents within the project area." Thus, the review of the source emissions and monitoring data in this step is an iterative process with two main questions to consider: (1) what does the ambient monitor represent, and (2) which nearby sources are or are not represented by the ambient monitoring data? Working through the visual and qualitative assessment of these data with these questions in mind should help one account for the inherent interconnectedness in fully representing background concentrations for use in the cumulative impact analysis. For each ambient monitor in consideration here, determining which nearby sources are or are not represented by that monitor will necessitate working through the qualitative considerations of the data gathered in step 2 and, as appropriate, quantitative analysis of the emissions, monitoring, and pre-existing modeling data.

In multi-source situations, the visual and qualitative assessment should include maps of the monitor locations, environmental data such as terrain features and wind patterns, and the locations and magnitude of emitting sources within the first 10 to 20 km of the source(s) under consideration (2017 *Guideline*, section 8.3.3(b)(iii)) and, if available, the area where the source(s) under consideration's impacts are greater than the SIL based on pre-existing modeling (i.e., the single source impact analysis)[23]. It is recommended to start with consideration of the

[23] The modeling results from the source(s) under consideration's single source impact analysis can be spatially plotted with EPA's AERPLOT tool to post-process any AERMOD dispersion modeling results that are available. The tool converts AERMOD plot file (.PLT) output to a .KMZ format for convenient plotting of the receptor field of ground level concentrations, contours, and concentration gradients. The executable for this tool can be found at: https://www.epa.gov/scram/air-quality-dispersion-modeling-related-model-support-programs#aerplot

closest monitors since the closer the monitor is to those sources, the more likely it is to be representative of the source mix in those areas. Focusing on monitors near the source(s) under consideration and any area with possible exceedances of the SIL is an appropriate narrowing of the scope to relevant nearby sources for consideration rather than looking across the entire modeling domain. The ambient concentration data at the selected monitor(s) along with the source and emissions data can be mapped with the wind patterns and terrain features to gain insights on the potential for these sources to be contributing to the monitor and the degree to which these contributions may be represented by the monitor data. Therefore, a visual assessment and qualitative comparisons of the data and their spatial patterns and relationships can be quite informative in understanding what sources are or are not represented by the monitoring data.

For certain pollutants and averaging times, the dispersion of the emitted plume will play an influential role as to whether the source contributions may be accounted for by the monitoring data. As stated in section 8.3.3(b)(i) of the 2017 *Guideline*, "[t]he pattern of concentration gradients can vary significantly based on the averaging period being assessed. In general, concentration gradients will be smaller and more spatially uniform for annual averages than for short-term averages, especially for hourly averages. The spatial distribution of annual impacts around a source will often have a single peak downwind of the source based on the prevailing wind direction, except in cases where terrain or other geographic effects are important. By contrast, the spatial distribution of peak short-term impacts will typically show several localized concentration peaks with more significant gradient." To qualitatively assess the potential contributions of emission sources to the monitor location, the source emissions data may be paired with wind rose data using the applicable averaging times (i.e., short term vs. long term) to understand the extent of plume dispersion and contributions to the monitor. As such, selecting a representative monitor for annual averaging times may be similar to the monitor selection in isolated source situations that reflect the uniform background contributions from other sources outside the modeling domain with some account for those smaller point and non-point sources within the project area. Alternatively, selecting a representative monitor for short-term averaging times should be based upon ambient monitoring data that reflects the higher variability expected from emission sources near the source(s) under consideration, while avoiding or minimizing a conservative account of such contributions if the number of such sources and their emissions are higher near the monitor than the source(s) under consideration. Selection of a representative short-term monitor could be expanded to more than one monitor based on consideration of realistic upwind sectors that would improve representation of higher variabilities and reduce conservatism from double counting of modeled nearby sources. Note that emission inventories are generally made up of annual totals of source emissions. Information on the operating hours for a source or hourly emission rates may be more informative for shorter term standards (i.e., 1-hr CO, NO_2, and SO_2).

The dispersion environment is also important here because the impact from an emitted plume is heavily influenced by local meteorology and the presence of terrain, bodies of water, and land surface characteristics. Visual assessment of the situation using terrain maps and wind roses will be extremely valuable to the qualitative assessment of what nearby source impacts are expected to be reflected in the monitoring data. Depending on the geographic location (i.e., urban vs. rural) of the source(s) under consideration and the ambient monitor location, one should use professional judgment to consider upwind sector influences from urban or rural non-point sources and rule out any lower emitting sources with impacts that are likely reflected in the monitor data and therefore adequately represented in those measured concentration data.

While selecting the monitor data for use in a multi-source situation, keep in mind that a degree of conservatism may be used to select a monitor that is biased high with respect to the project area in cases where it is unclear or uncertain what source mix a monitor is representing. A conservative assumption may be selecting a monitor that is clearly impacted by a large emitting source or multiple sources that are not reflected in the source mix near the source(s) under consideration, or selecting a monitor located in an urban area when the source(s) under consideration is in a more rural location. In addition, the options for modifying the ambient data record detailed in section 3.3 also apply to multi-source situations; however, additional data analysis may be necessary to make these modifications given the added complexity of distinguishing source contributions in multi-source areas.

In summary, the visual and qualitative assessment of the available data described above should result in the selection of a monitor (or monitors) and a detailed understanding of what those monitoring data represent. The selected monitoring data should meet EPA's recommended methods for data collection and processing[9], and the quality assurance and quality control requirements[10]. These monitoring data should generally represent contributions from other sources within and outside of the modeling domain, and the identified emission sources near the selected monitor. This full and documented understanding of what the selected monitor(s) represents should then inform and facilitate the next step of identification of those nearby sources that are not adequately represented by the monitored data and need to be explicitly modeled.

4.4 Determination of Nearby Sources to Explicitly Model

The fourth and final step of the framework, as applied to multi-source situations, is to determine which nearby sources to explicitly model. This step builds on the visual and qualitative review that is performed while selecting the monitor in step 3. As stated in section 8.3.3(b)(ii) of the 2024 *Guideline*, “Nearby sources not adequately represented by the ambient monitor through visual assessment should undergo further qualitative and quantitative analysis before being explicitly modeled.” Thus, the nearby sources identified in step 3 that are not accounted for in the monitored data should be further analyzed to determine whether to explicitly model them as part of the cumulative impact analysis. The additional analysis in this step should build on the visual and qualitative assessment completed in step 3 with the result of this iterative process being the identification of few, if any, nearby sources whose contributions are not adequately represented by the selected ambient monitoring data. Note that there may be no nearby sources to explicitly model if they are all adequately represented in the background monitoring data.

The nearby sources under consideration will typically be within the first 10 to 20 km from the primary source(s) under consideration and any area where the primary source’s impacts equal or exceed the SIL. Those emission sources located in proximity to areas where the source under consideration’s single source impact analysis indicates modeled exceedances of the SIL are important to consider in order to appropriately represent local air quality for the cumulative impact analysis. This is especially true in PSD compliance demonstrations because identifying potential NAAQS and PSD increment violations is essential to determine if a new source may cause or contribute to such violations. An initial approach to determine whether to explicitly model those sources identified in step 3 as not being represented in the selected monitoring data would be to explicitly model those nearby sources that are in close proximity to the source(s) under consideration and any area where the source impacts exceed the SIL. Such an approach would be the most straightforward determination consistent with the outcome of step 3 and not necessitate additional qualitative or quantitative analysis to inform the determination here.

However, if there is any question as to whether the sources identified in step 3 should be modeled, this section provides information on how to further evaluate the spatial extent of these nearby source impacts to inform determining the need for explicit modeling of these sources to fully and credibly estimate background concentrations. The following questions will assist in assessing the representation and resulting dispersion of emissions from the nearby sources. In cases where existing modeling of the nearby source(s) may not be available, these questions should still be considered to understand the spatial nature of the emitted plumes from each source.

- How far are the nearby sources from the source(s) under consideration?
    - The 2017 Guideline states that "[i]n most cases, the few nearby sources will be located within the first 10 to 20 km from the source(s) under consideration."
- What terrain features are present around the nearby sources and source(s) under consideration?
    - Terrain maps can show what features may influence overlapping project and nearby source impacts. For example, large terrain features that may obstruct the emissions from a nearby source from impacting the source(s) under consideration's significant impact area.
- What are the wind patterns influencing plume dispersion from the nearby sources?

- A wind rose may be useful for this question to assess the frequency that the prevailing wind blows from the nearby source toward the source(s) under consideration.

- If the nearby sources have stacks, what are the stack parameters (height, temperature, exit velocity, and diameter)?
    - A short stack (e.g., less than ~100 ft) may have localized impacts at the ambient air boundary (e.g., fenceline), while a tall stack (e.g., greater than ~100 ft) will likely have impacts farther away.
- Would downwash play a role in the dispersion of a pollutant from the nearby sources such that they may cause elevated concentrations in the vicinity of the source(s) under consideration?
    - Downwash may be important to consider for a nearby source located on the facility property or sources that are located within the proposed source's modeled significant impact area.

Leveraging the visual and qualitative assessment completed in step 3, these questions should be used to further evaluate the relevant monitoring, emissions, source characteristics, and modeled data and help inform the determination in this step.

In cases where pre-existing modeling of a nearby source is available, post-processing and additional analysis of emissions data and existing modeling results can provide an understanding of the spatial extent of each source's impacts and how they overlap with the source(s) under consideration's impacts. These modeling results may be available from previous permit actions through the state or local agency's inventory. If available, these results should be spatially plotted to visualize how those nearby source impacts overlap with the source(s) under consideration's impacts and the selected monitor(s) from step 3. If modeling results are not available, existing dispersion modeling of similar types of sources (e.g., an elevated source in a rural, flat terrain area or a ground release in an urban area with a similar wind pattern) could provide insights on the potential dispersion of an emitted plume from a nearby source. The spatial plots generated from the source(s) under consideration and nearby source's dispersion modeling can be used to identify any areas where their concentration impacts overlap. If a monitor has been selected, one should combine the design value from the selected monitor, concentration impacts from the source(s) under consideration, and the estimated concentration impacts from the nearby source(s) to calculate a preliminary design concentration to see if the resulting air quality level may threaten or exceed the NAAQS or PSD increment. If impacts from the nearby source(s) contribute to estimated air quality levels that may threaten or exceed the NAAQS or PSD increment, then these nearby sources should be strongly considered for explicit modeling as part of the cumulative impact assessment. When using pre-existing modeling, one should use their best professional judgment to determine whether the nearby source and dispersion environment are properly represented in the modeling that was previously performed. In general, consideration of quantitative approaches to inform the determination of which nearby sources to explicit model should be determined in consultation with the appropriate reviewing authority and fully described in the modeling protocol and technical documentation of the cumulative impact analysis.

The visual, qualitative, and quantitative assessments completed as part of this step in determining those nearby sources to explicitly model should be fully documented to provide the basis for justification in the decisions. Such documentation will be particularly important for nearby sources that are not explicitly modeled, so EPA recommends including the rationale for that decision as well as for those nearby sources that are explicitly modeled.

In regard to the use of the explicit modeling of nearby sources in the cumulative impact analysis, unlike the recommendation to not hourly pair the monitoring data for this purpose, we do recommend hourly pairing on the explicit modeling of nearby sources with the source(s) under consideration modeling results because the use of the same meteorological inputs within the preferred air quality model provide a credible and appropriate basis to do so.

5. Additional Considerations

Additional considerations in determining background concentrations may include accounting for at-risk communities in ensuring the adequacy of local air quality characterization in these communities, especially in the case of multi-source areas where there is the potential for modeled violations of the NAAQS or PSD increment as part of the cumulative impact assessment. Listed below are tools that are currently available to permit applicants and state or tribal air agencies who may be requested by their reviewing authority to perform a demographic screening analysis or otherwise consider at-risk communities as part of their modeling demonstration. The inclusion of this information does not infer any requirement that modeling demonstrations include such analysis, but rather is intended to provide useful references to tools that may assist in doing so.

The following tools may be useful in defining at-risk communities or performing a demographic screening analysis:

- EPA's Environmental Justice Screening and Mapping Tool[24]: EJScreen can be used to characterize the nature of the demographics for population living near the new or

[24] For more information on EPA's Environmental Screening and Mapping Tool please refer to: EJScreen: Environmental Justice Screening and Mapping Tool | US EPA

modifying source and use the demographic index (or other indicators) to define communities of concern that would be the focus of air quality impacts.

- The Climate and Economic Justice Screening Tool[25]: CEJEST is a geospatial mapping tool that identifies areas across the nation where communities are faced with significant burdens. It can be used to identify communities in the project area that may be burdened by climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.
- Any other tool that can be utilized to enhance understandings of nearby source control strategies and EJ intersections relevant to the project at hand, and whether to expand inclusion of certain nearby sources in multi-source areas. This can include tools developed by state and local air agencies.[26]

These tools may be used to determine the overlap of such communities with the source(s) under consideration's impacts, selected representative monitor location and/or determination of nearby sources to include in the cumulative impact assessment and confirm the adequacy of the characterization of background concentrations to represent local air quality in these communities.

6. Summary

This guidance provides the EPA's recommended framework that offers clear and logical steps to be used with inherent professional judgment and discretion to develop a representative account for background concentration in the modeling domain of the source(s) under consideration. The framework should be applied in both isolated single source and multi-source area situations. Specifically in multi-source areas, the framework assists in the identification of

[25] For more information on the Climate and Economic Justice Screening Tool please refer to: Climate and Economic Justice Screening Tool | U.S. Climate Resilience Toolkit
[26] A list of links to state and local EJ tools can be found at: https://www.epa.gov/ejscreen/related-tools

nearby sources that should be explicitly modeled as part of a cumulative impact assessment. The aim of this framework is to foster consistency across modeling demonstrations with sufficient documentation to justify NAAQS and PSD determinations as part of the modeling protocol or permit record. Consistent with the EPA framework, permit applicants and state agencies can consider qualitative and quantitative approaches that may not be explicitly noted in this guidance document to better inform their determination and EPA recommends such pursuit is done in consultation with the appropriate reviewing authority.

7. References

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Appendix A: Detailed Table of Available Air Quality, Emissions, and Environmental Data

<u>**Air Quality Data**</u> **Ambient monitoring data**
Ambient monitoring data can come from a number of different sources such as the applicable state and local agency's ambient air monitoring networks, pre- or post-construction monitoring, or an EPA ambient air monitoring network. Any data that is selected for use as the design concentration should meet the QA/QC requirements detailed in the *Ambient Monitoring Guidelines for Prevention of Significant Deterioration* (EPA-450/4-87-007). Ambient monitoring data from state and local agencies may be made available through their websites or through contact with the appropriate reviewing authority. Additionally, the reviewing authority may have knowledge on any existing pre- or post-construction monitoring that is available for the project or nearby source. Links to state/local/tribal Ambient Air Monitoring Network Plans can be found at: https://www.epa.gov/amtic/state-monitoring-agency-annual-air-monitoring-plans-and-network-assessments EPA has various platforms to access ambient air monitoring data depending on the data needed based on the NAAQS pollutant standard. Please visit the following website for access and information to outdoor air monitoring data: https://www.epa.gov/outdoor-air-quality-data/what-best-way-access-outdoor-air-monitoring-data Information and access to air quality design value data for NAAQS pollutants can be found at: https://www.epa.gov/air-trends/air-quality-design-values#dvtool EPA's AirData Air Quality Monitors app – Interactive Map of Air Quality Monitors (active and inactive) (measurement scales: micro-scale (0 m to 100 m), middle scale (100 m to 500 m), neighborhood scale (500 m to 4 km), urban scale (4 km to 50 km), and regional scale (50 km to hundreds of km)): https://www.epa.gov/outdoor-air-quality-data/interactive-map-air-quality-monitors

<u>Emissions Data</u>

Emissions information and modeling files for existing PSD sources

The applicable state or local environmental agency may provide lists of all sources or air permits (e.g., Title V, minor source, and other state-only issued permits) in their jurisdiction or even have some sort of PSD inventory tool containing permit and modeling information. EPA recommends searching the state or local environmental agency's website first to investigate what information and tools may be available. One may also contact the appropriate reviewing authority (and potentially adjacent authority) to obtain additional data on nearby sources such as relevant modeling files and emissions and stack parameter data if they are tracked by the state or local agency. Emission inventories and modeled emission rates may also be constructed from nearby source air quality operating permits, recent permit applications, and appropriate emission limits. PSD permit applications for proposed or new sources should also be reviewed for any emissions data relevant to the cumulative modeling demonstration and nearby sources inventory.

Power plant NO_X and SO_2 emissions data can be found at EPA's Clean Air Markets Program Data page: https://campd.epa.gov/

Source operating hours and short-term emissions rates may be available through facility-level Continuous Emissions Monitoring Systems (CEMS) and EPA's Clean Air Market Division Field Audit Checklist Tool: https://www.epa.gov/power-sector/field-audit-checklist-tool-fact

The National Emissions Inventory (NEI) includes source emissions and stack information which may be found in EPA's Emissions Inventory System (EIS): https://www.epa.gov/air-emissions-inventories/emissions-inventory-system-eis-gateway

<u>Environmental Data</u> **Terrain data**
The primary site for accessing the most up-to-date elevation data is the USGS National Map. This data should be used to assess the presence of terrain features in the modeling domain that may affect the dispersion and potential overlap of emitted plumes from the project or nearby sources. USGS National Map: https://www.usgs.gov/programs/national-geospatial-program/national-map USGS National Map – Data Download Map: https://apps.nationalmap.gov/viewer/ Information on how the national elevation data can be converted for use in the AERMOD modeling system can be found at: https://gaftp.epa.gov/Air/aqmg/SCRAM/models/related/aermap/Access_and_Conversion_of_Elevation_Data_for_AERMAP.pdf.
Land use data
Land cover data can be retrieved from the National Land Cover Database (NLCD). The primary site where you can get the most up-to-date information is the Multi-Resolution Land Characteristics (MRLC) Consortium website. NLCD data can be plotted or viewed using the MRLC's viewer to review the land cover characteristics for the modeling domain. Review of this data will provide knowledge on the location (urban vs. rural) of the source(s) under consideration and how the land use may impact surface characteristics and the dispersion of emitted plumes. Multi-Resolution Land Characteristics (MRLC) Consortium: https://www.mrlc.gov/ Multi-Resolution Land Characteristics (MRLC) Consortium NLCD Viewer: https://www.mrlc.gov/viewer/ For more information on the use of land cover data in the AERMOD Modeling System: https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/AERMOD_Data_Resources.pdf

Local meteorological data

For the purposes of determining an appropriate background concentration, there are a number of meteorological datasets and resources that may be used (see section 8.4 of the Guideline). In some cases, there may be observed on-site or site-specific meteorological observations for the source(s) under consideration or nearby sources that can be accessed through the appropriate reviewing authority. The National Oceanic and Atmospheric Administration (NOAA) also have databases of hourly surface observations that are generally collected at airports by the National Weather Service and/or the Federal Aviation Administration (Integrated Surface Dataset). There are also datasets with 1-minute and 5-minute wind data from ASOS sites across the country. Finally, prognostic meteorology data generated by the Weather Research and Forecasting (WRF) model and processed for input to AERMET by the Mesoscale Model Interface Program (MMIF), may be used in cases where the monitored meteorological data is not representative of the area surrounding the source(s) under consideration. Local meteorological data, more specifically wind speed and direction, may be used to estimate plume dispersion and determine monitor representativeness. Wind speed and direction data may be used to generate a wind rose using one of the many data visualization tools on the market including a tool from Iowa State University that quickly generates wind rose plots.

NOAA/NCEI Integrated Surface Dataset (ISD): https://www1.ncdc.noaa.gov/pub/data/noaa/
NOAA/NCEI 1-Minute ASOS Wind Data: https://www.ncei.noaa.gov/data/automated-surface-observing-system-one-minute-pg1/access/
NOAA/NCEI 5-Minute ASOS Wind Data: https://www.ncei.noaa.gov/data/automated-surface-observing-system-five-minute/access/
Iowa State University Wind Rose Tool: https://mesonet.agron.iastate.edu/sites/locate.php?network=GA_ASOS

For more information on the use of meteorological data in the AERMOD Modeling System:
https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/AERMOD_Data_Resources.pdf
https://gaftp.epa.gov/Air/aqmg/SCRAM/models/met/aermet/aermet_userguide.pdf
https://gaftp.epa.gov/Air/aqmg/SCRAM/models/related/mmif/MMIF_Guidance.pdf

<u>Additional Useful Data</u>

Information on demographic characteristics of population and/or existence of disadvantaged communities

EPA's Environmental Justice Screening and Mapping Tool (EJScreen) and the Climate and Economic Justice Screening Tool (CEJEST) are two tools that can be used to collect information on the demographic characteristics and presence of disadvantaged communities in the project area. EJScreen is an environmental justice mapping and screening tool that provides a nationally consistent dataset and approach for combining environmental and demographic socioeconomic indicators. CEJEST has an interactive mapping tool that can be used to identify communities experiencing burdens in eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.

EJScreen: https://www.epa.gov/ejscreen
CEJEST: https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

Appendix B: Hypothetical Examples of Developing a Background Concentration: Isolated Source Scenarios

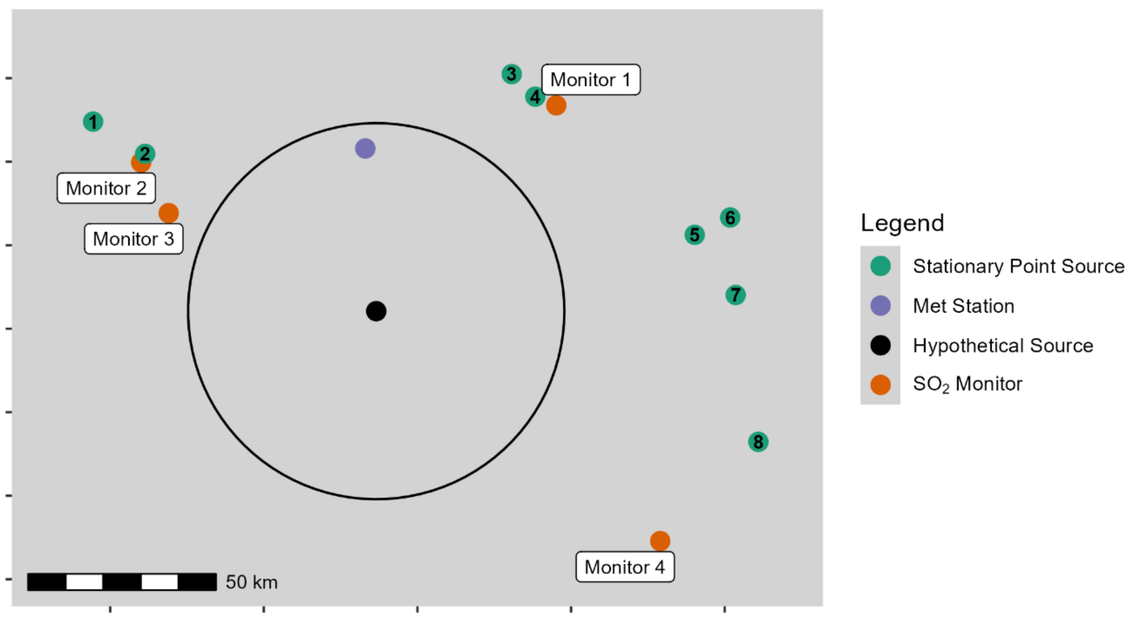
The following hypothetical examples present procedures under the EPA recommended framework to develop background concentrations for a cumulative impact assessment in an isolated source situation. The three hypothetical scenarios presented below illustrate how to determine a representative monitor for a modeling demonstration of an isolated source. The EPA recognizes that these scenarios do not provide specific details that should be included in a real-world modeling demonstration such as identifying details on the source(s) under consideration, nearby sources, air quality and meteorological monitors, and other case-specific details on the local area and dispersion environment. To that end, the EPA plans to replace these hypothetical examples with ones gained from real-world modeling demonstrations through the exercise of this guidance. In applying the framework, we recommend consulting with the appropriate reviewing authority and EPA regional office on the details of each step, as appropriate.

B.1 Scenario 1: Representative regional background monitor available

B.1.1 Define the scope of the cumulative impact analysis

A hypothetical new source is planning to locate in a rural area, located approximately 65 km SE of City 1 and 70 km SSW of City 2. The following procedures are used to determine a representative background concentration to be included in a modeling demonstration for compliance with the 1-hour SO_2 NAAQS of 75 ppb. Figure B1 presents a map of the project area with the location of the hypothetical new source plotted alongside the available monitors and the closest nearby sources. In this example, a single-source impact analysis is not available for the hypothetical source therefore the modeling domain will be defined at 50 km to align with the recommendation made in Section 8.1.2 of the Guideline that “[the] impact area is defined as an area with a radius extending from the new or modifying source to […] the nominal 50 km distance considered applicable for Gaussian dispersion models". The black circle in Figure B1 represents the 50 km modeling domain around the hypothetical new source. There are no ambient SO_2 monitors, or nearby stationary point sources located within the 50 km modeling domain.

Figure B1. Map of project area surrounding the hypothetical new isolated source: Scenario 1



B.1.2 Identify relevant and available emissions, air quality and environmental data

Table B1 presents a list of the available SO_2 monitors that are located nearest to the hypothetical source. The location and design value information related to these monitors were identified using EPA's Interactive Map of Air Quality Monitors.[27] As presented in Figure B1, none of the active ambient monitors are located within the 50 km modeling domain. Three of the

[27] https://www.epa.gov/outdoor-air-quality-data/interactive-map-air-quality-monitors

monitors are located in urban areas relative to the location of the hypothetical source and all three of these monitors are defined as neighborhood scale. Monitors 2 and 3 are located in City 1 and are 75 km and 60 km distance from the hypothetical source while monitor 1 is located in City 2, 75 km from the hypothetical source. Monitor 4 is a regional scale monitor located in a rural area SE of the hypothetical source.

Meteorological data (i.e., wind speed and direction) for the project area was collected at the nearest monitor for the years 2021 to 2023 and has been plotted in a wind rose in Figure B2. This site is located within the modeling domain and was selected over other nearby meteorological sites given its rural location and closer proximity to the hypothetical source. The meteorological site is located 42 km from the hypothetical source. Wind directions at this site across the three years of data are consistently out of the west. The 2021 edition of National Land Cover Data was downloaded from the MRLC and has been plotted in Figure B3 alongside the locations of the hypothetical source, SO_2 monitors and other permitted sources.

Table B1. Table of ambient SO_2 monitors in the vicinity of the hypothetical new isolated source: Scenario 1

Monitor Name	1-hour SO_2 2021-2023 Design Value [ppb]	Monitor Classification	Distance from Hypothetical Source
Monitor 1	2	Neighborhood Scale (0.5 – 4 km)	75 km
Monitor 2	6	Neighborhood Scale (0.5 – 4 km)	75 km
Monitor 3	6	Neighborhood Scale (0.5 – 4 km)	60 km
Monitor 4	1	Regional Scale (50 – 100km)	95 km

Figure B2. Wind rose of meteorological data collected at the local station: 2021 - 2023

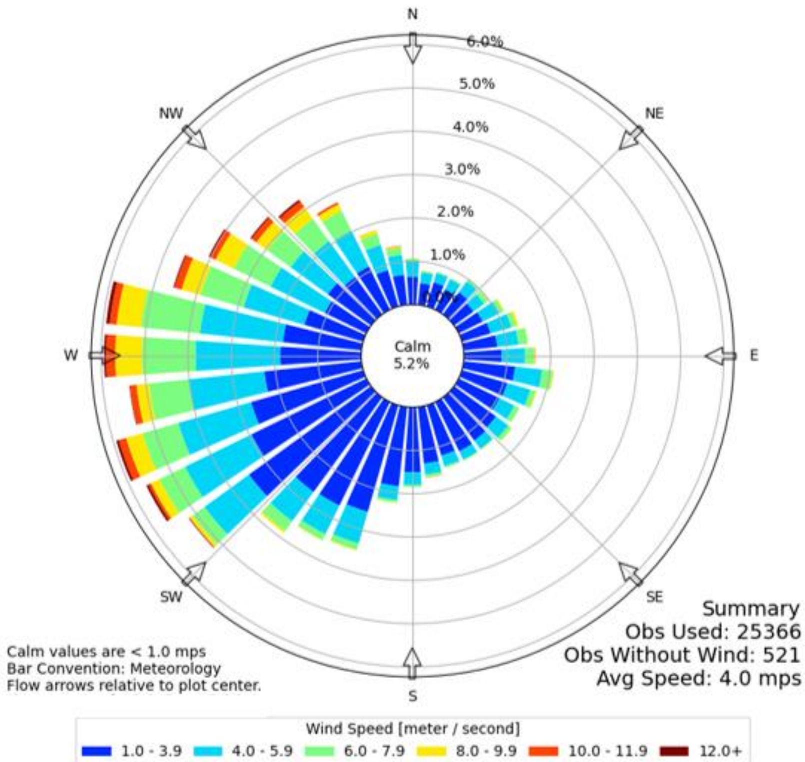
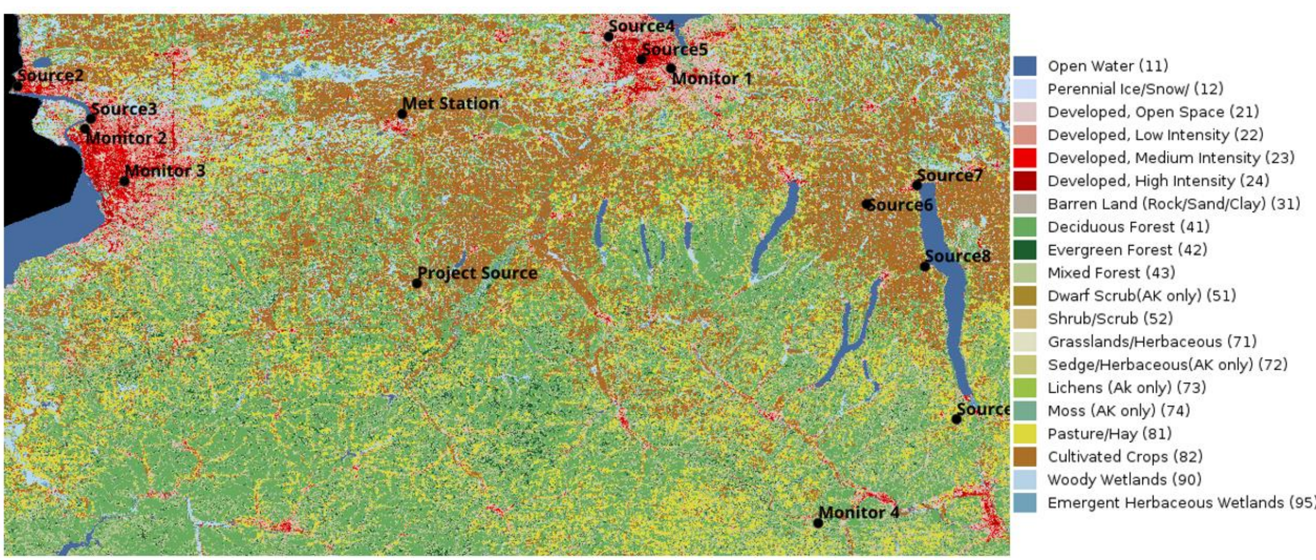


Figure B3. Map of land cover data for the area surrounding the hypothetical new isolated source



B.1.3 Determining representativeness of ambient monitor data

Of the four ambient monitors considered in this example, monitor 4 is located in a dispersion environment most similar to the location of the hypothetical source. Considering the primary wind direction is from the west, monitor 4 is not downwind of any stationary point sources. Monitor 4 is also defined as a regional scale monitor and therefore is expected to be representative of the regional background in a rural, mostly undeveloped area, similar to the location of the hypothetical source under consideration. The other three monitors located nearest to the hypothetical source would be overly conservative of the background concentration in the location of the hypothetical source because they are located in urban locations in close proximity to point sources impacting the monitored concentrations. Given the 1-hour averaging period of the modeling demonstration, transported impacts from the point sources located outside of the 50 km modeling domain do not need to be considered and selecting a monitor that reflects these impacts would not be representative of the location of the hypothetical source. Therefore, monitor 4 should be selected to represent the monitored background concentration for SO_2.

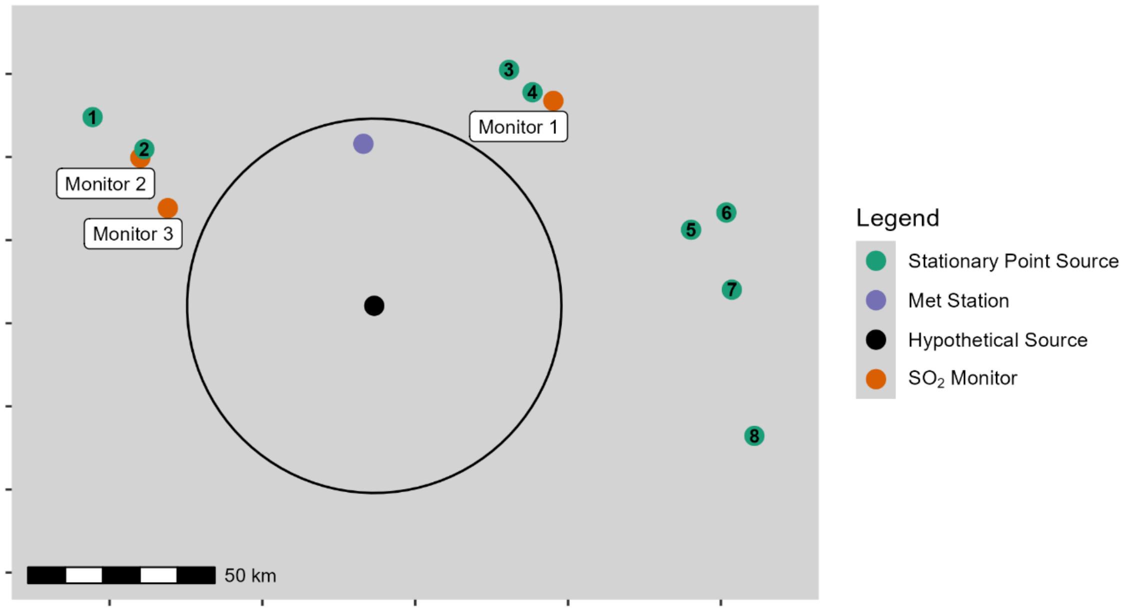
B.2 Scenario 2: No regional background monitor available

Scenario 2 is a modification of Scenario 1 presented above where a representative regional background monitor is not available in the vicinity of the hypothetical new source.

B.2.1 Define the scope of the cumulative impact analysis

For this scenario, we will consider the same project area from Scenario 1 but monitor 4 is not available. Figure B4 presents a map of the project area including the three available ambient monitors and nearby sources located in the vicinity of those monitors.

Figure B4. Map of project area surrounding the hypothetical new isolated source: Scenario 2



B.2.2 Identify relevant and available emissions, air quality and environmental data

The same environmental data collected in Scenario 1 applies to this example. Table B1 lists the three monitors available in this example (monitors 1 through 3). These monitors are all neighborhood-scale monitors located in the two urban areas outside of the modeling domain for the hypothetical source. To determine the representativeness of these monitors we will consider the monitor location with respect to nearby sources and the scale of emissions from those sources. The monitoring networks for pollutants like SO_2 and NO_2 are generally source-oriented; therefore, these monitors may have been cited in the area of maximum impact for a local source. Table B2 provides location and emissions information for nearby sources located in the vicinity of the three monitors available.

Table B2. Table of nearby sources in close proximity to the ambient SO_2 monitors: Scenario 2

Source Number	Closest Monitor	Distance to Monitor [km]	Direction with Respect to Monitor	2023 Reported SO_2 Emissions [tons / year]
2	Monitor 2	2.5	NNE	2,608
3	Monitor 1	13.5	NW	1,364
4	Monitor 1	5.5	W	324

B.2.3 Determining representativeness of ambient monitor data

Of the three available monitors, monitor 2 is within closest proximity to a major SO_2 source (#2) emitting over 2,000 tons per year. Although the nearby source is located to the north-northeast of the monitor, and winds are predominately out of the west, the design value at this monitor is likely influenced by impacts from this source considering they are only 2.5 km apart. Monitor 3 is not in close proximity to any nearby sources; however, the design value of 6 ppb is representative of its location in an urban neighborhood. Monitor 1 has two SO_2 sources located within 15 km of it. The monitor is situated directly 5.5 km downwind (i.e., east) of one of the nearby sources (#4) with reported SO_2 emissions in 2023 of 324 tons per year. The second nearby source (#3) within the vicinity of monitor 1 is over 13 km away and impacts from this source may not influence the monitor when considering a 1-hour averaging period. If we were considering a longer-term standard, impacts from this nearby source would need to be more closely considered. Monitor 1 has a design value of 2 ppb which is lower than the design value reported in the other local urban area. Considering the design value and the magnitude of source emissions within the vicinity of monitor 1, it seems to be the most representative SO_2 monitor to provide background concentrations for this scenario.

B.3 Scenario 3: No representative background monitor in the vicinity of project area available

Scenario 3 is a modification of Scenarios 1 and 2 presented above where there is not a representative background monitor available in the vicinity of the project area.

B.3.1 Define the scope of the cumulative impact analysis

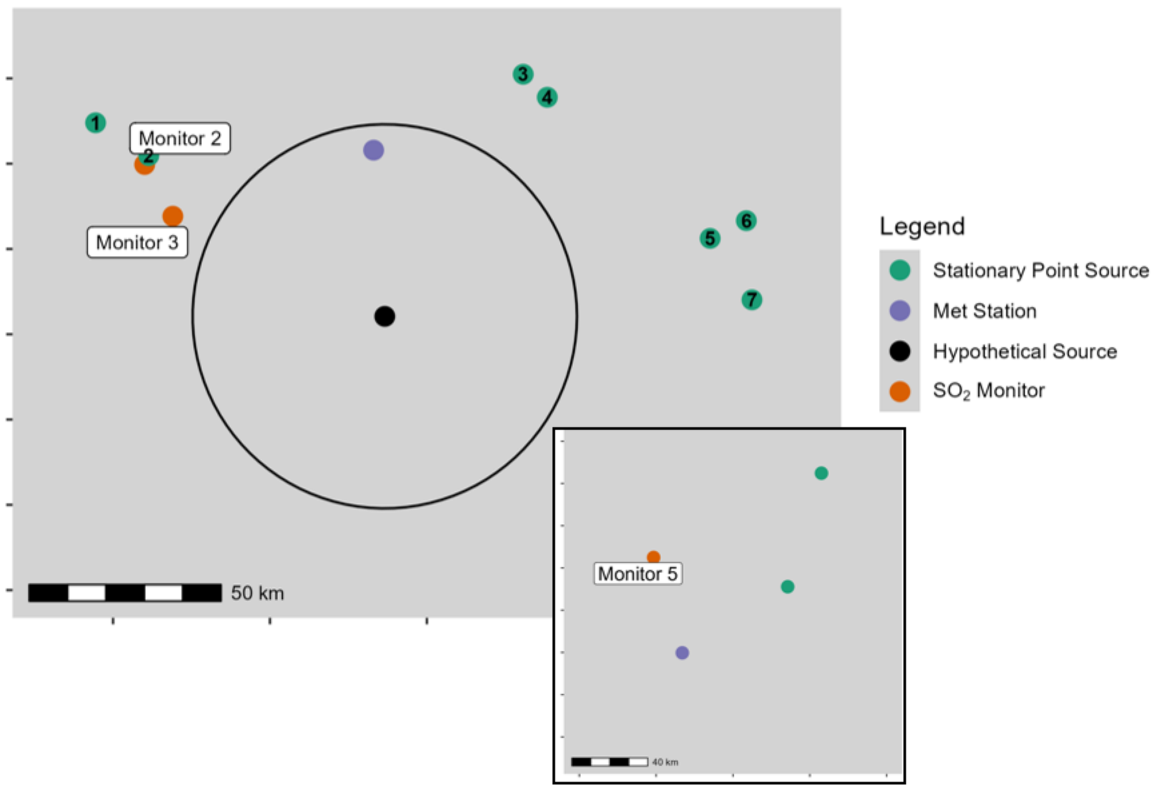
For this scenario we modify the hypothetical example in Scenario 2 by considering the same project area without the availability of monitors 1 and 4. Figure B5 presents a map of the project area including the two available ambient monitors and nearby sources located in the vicinity of those monitors.

B.3.2 Identify relevant and available emissions, air quality and environmental data

The same environmental data collected in each of the previous scenarios apply to this example. Table B3 lists the ambient monitors available for this example. Monitors 2 and 3 were identified in scenario 1 for the project area. These neighborhood-scale monitors are located in the same urban city located outside of the modeling domain, to the northwest of the hypothetical source. Considering the urban location of these two monitors with respect to the isolated, rural location of the hypothetical source, it is necessary to identify additional ambient SO_2 monitors to find a monitor that is representative of this project area.

Using EPA's Interactive Map of Air Quality Monitors, we are able to identify an additional SO_2 monitor that is located in a rural area with a similar dispersion environment as the location of the hypothetical source. Using the EPA-hosted mapping tool, we identified a more distant monitor #5 outside of the project area for consideration as the representative ambient monitor. Monitor 5 is a regional scale monitor located at a rural county airport in a different part of the state, located over 300 km from the hypothetical source location. Figure B6 presents the meteorological data from the station nearest to monitor 5 for the years 2021 to 2023. The location of monitor 5, the local meteorological station, and any nearby sources are plotted on the land cover map presented in Figure B7. The nearest SO_2 source to monitor 5 is located approximately 70 km to the west-northwest. The meteorological station is located approximately 50 km south of monitor 5.

Figure B5. Map of project area surrounding the hypothetical new isolated source: Scenario 3



B.3.3 Determining representativeness of ambient monitor data

Monitor 2 is located 2.5 km away from a major SO_2 source that likely influences the design value at this monitor. Monitor 3 is located in an urban neighborhood and is representative of greater SO_2 impacts than those expected in the rural location of the hypothetical source. Using either of these monitors would likely overestimate the background concentrations surrounding the hypothetical source. Therefore, monitor 5, a regional scale monitor located in another rural area of the same state would be deemed more representative of the background concentration for this modeling demonstration. Monitor 5 is an isolated monitor, not affected by any major nearby SO_2 sources and is located in a dispersion environment similar to that of the hypothetical source. Slight differences in the two areas include: (1) monitor 5 is in a forested area while the hypothetical source is surrounded by more land covered in low lying shrubs, and (2) winds at monitor 5 are predominately out of the northwest while winds at the project area are out of the west. However, there are no sources located to the west or northwest of monitor 5 so it isn't influenced by nearby source impacts which make it more representative of a rural background similar to the location of the hypothetical source.

Table B3. Table of ambient SO_2 monitors in the vicinity of the hypothetical new isolated source: Scenario 3

Monitor Name	1-hour SO_2 2021-2023 Design Value [ppb]	Monitor Classification	Distance from Hypothetical Source
Monitor 2	6	Neighborhood Scale (0.5 – 4 km)	75 km
Monitor 3	6	Neighborhood Scale (0.5 – 4 km)	60 km
Monitor 5	1	Regional Scale (50 – 100km)	305 km

Figure B6. Wind rose of meteorological data collected at the station near monitor 5 between 2021 and 2023

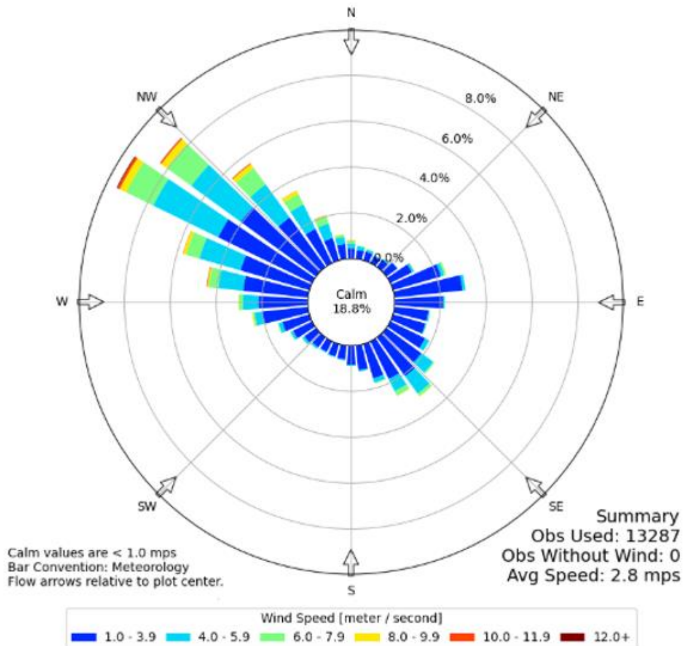
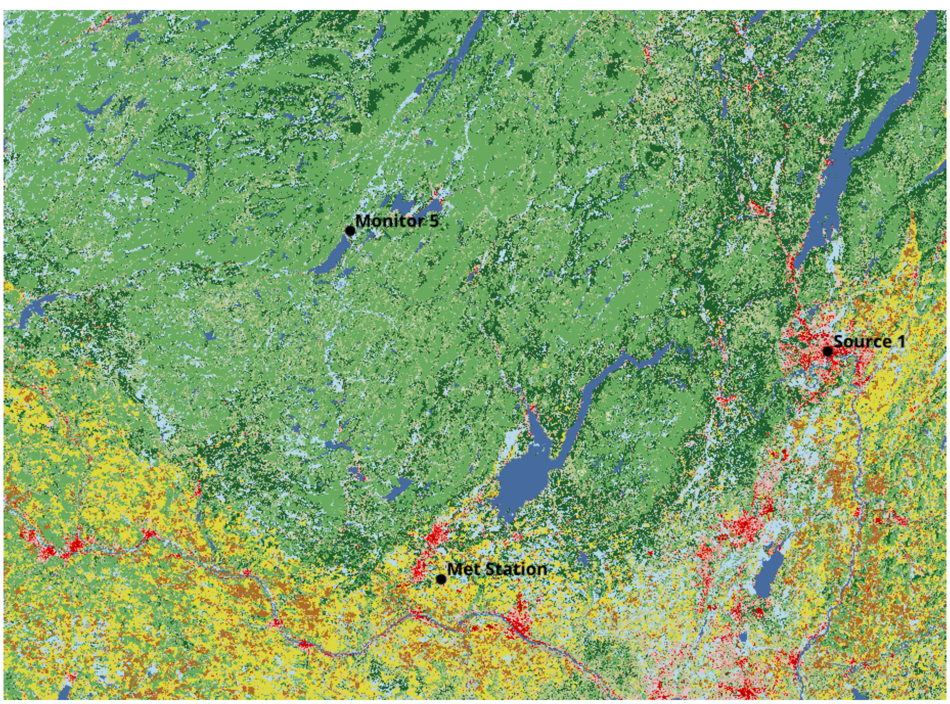


Figure B7. Map of land cover data for the area surrounding monitor 5



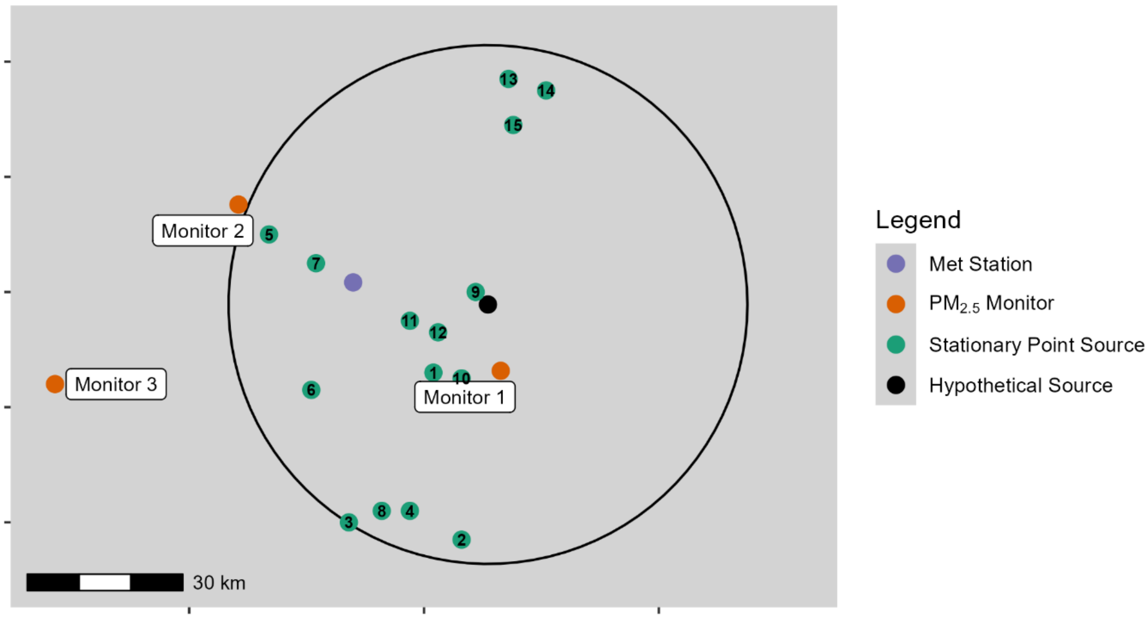
Appendix C: Hypothetical Example of Developing a Background Concentration: Multi-source Scenario

The following hypothetical example presents procedures under the EPA recommended framework to develop background concentrations for a cumulative impact assessment in a multi-source scenario. The hypothetical scenario presented below illustrates how to determine a representative monitor and select nearby sources for explicit modeling as part of a modeling demonstration in a multi-source scenario. The EPA recognizes that these scenarios do not provide specific details that should be included in a real-world modeling demonstration regarding the hypothetical source, nearby sources, air quality and meteorological monitors, and other case-specific details on the local area and dispersion environment. To that end, the EPA plans to replace these hypothetical examples with ones gained from real-world modeling demonstrations through the exercise of this guidance. In applying the framework, we recommend consulting with the appropriate reviewing authority and EPA regional office on the details of each step, as appropriate.

1. Define the scope of the cumulative impact analysis

A hypothetical source is planning to locate in a small town situated approximately 85 km east of a large city and 80 km south of another city. The following procedures are used to determine a representative background concentration to be included in a modeling demonstration for compliance with the annual $PM_{2.5}$ NAAQS of 9 $\mu g/m^3$. Figure C1 presents a map of the project area with the location of the new source plotted alongside the available ambient air quality monitors, the local meteorological station, and known nearby stationary point sources. Again, the modeling domain shown in Figure C1 is defined at 50 km which is indicated by the black circle around the hypothetical source.

Figure C1. Map of project area surrounding the hypothetical new source in the multi-source situation



2. Identify relevant and available emissions, air quality and environmental data

As shown in Figure C1, there are three ambient $PM_{2.5}$ monitors located in the vicinity of the hypothetical source that were identified using the EPA Interactive Map of Air Quality Monitors.[28] Table C1 presents information on the monitor site, classification, proximity to the hypothetical source and the 2021-2023 certified design value for each of the three monitors. Monitor 1 is the closest monitor to the location of the hypothetical source, is the only monitor located within the 50 km modeling domain and is classified as a regional scale monitor. Monitor 2 is a neighborhood scale monitor located just outside of the modeling domain and monitor 3 is an urban, neighborhood scale monitor located in the large city to the west of the hypothetical

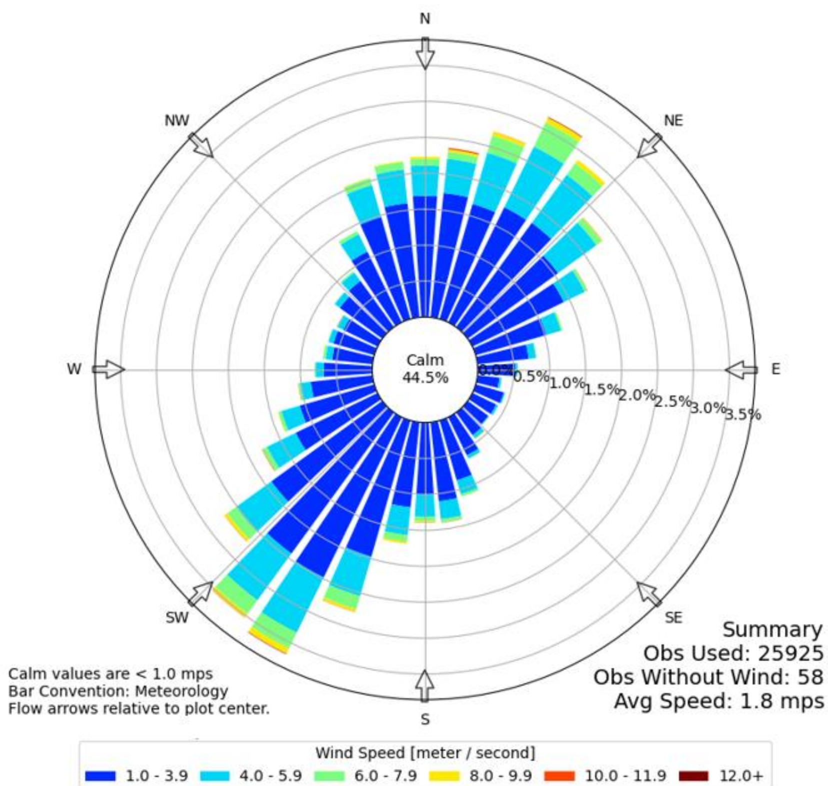
[28] https://www.epa.gov/outdoor-air-quality-data/interactive-map-air-quality-monitors

source and information on this monitor was pulled to have a reference to urban $PM_{2.5}$ design values in the project area.

Table C1. Table of available ambient $PM_{2.5}$ monitors in the vicinity of the hypothetical new source in the multi-source situation

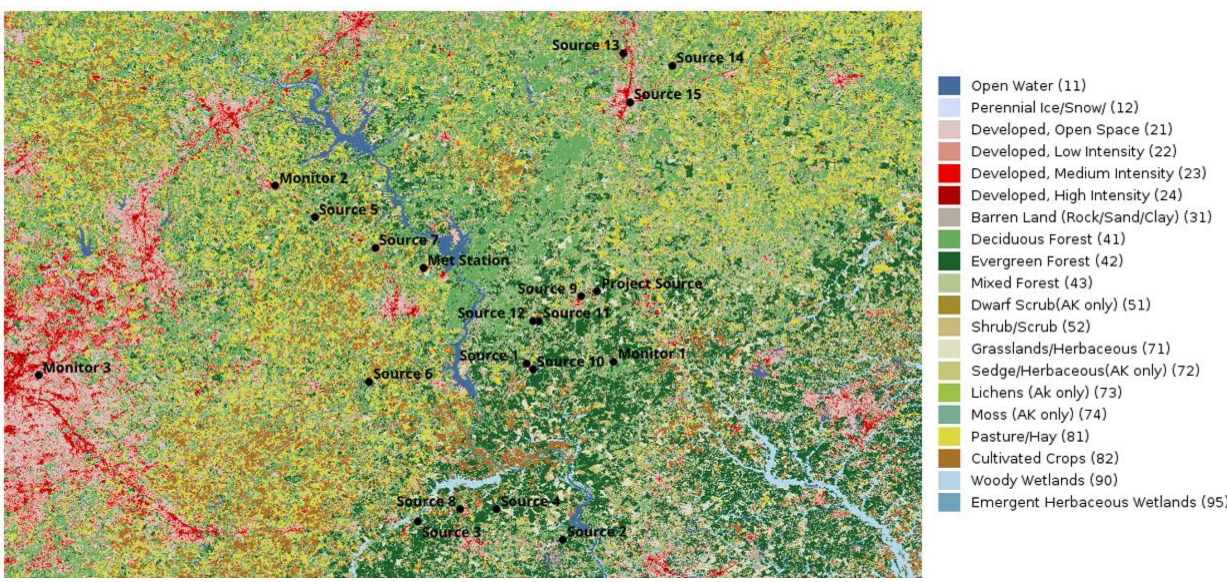
Monitor Name	2021-2023 Design Value [µg/m³]	Monitor Classification	Distance from Hypothetical Source
Monitor 1	**8.3**	Regional Scale (50 – 100 km)	13 km
Monitor 2	**8.2**	Neighborhood Scale (0.5 – 4 km)	51 km
Monitor 3	**8.2**	Neighborhood Scale (0.5 – 4 km)	85 km

Figure C2. Wind rose of meteorological data collected at the local county airport station between 2021 and 2023



Meteorological data (i.e., wind speed and direction) for the project area was collected from a local county airport station for the years 2021 to 2023 and is shown in the wind rose presented in Figure C2. This site is located within the modeling domain and was selected over other nearby meteorological sites given its rural location and availability of the most recent years of data. The meteorological site is located approximately 25 km from the hypothetical source. Based on three years of data at this site, wind directions are equally out of the south-southwest and north-northeast with nearly half the dataset measuring calm wind speeds (i.e., less than one meter per second). The 2021 edition of National Land Cover Data was downloaded from the MRLC and has been plotted in Figure C3 alongside the locations of the hypothetical source, $PM_{2.5}$ monitors and other permitted sources.

Figure C3. Map of land cover data for the area surrounding the hypothetical new source in the multi-source situation



Nearby sources within the modeling domain of the hypothetical source were initially identified using a state air agency hosted web-based facility mapping tool.[29] The buffer option in

[29] The EPA recommends the use of any facility mapping tools that may be available through the applicable state or local air agency.

this tool identified 15 Title V permitted sources within the 50 km domain of the hypothetical source. Information on these 15 nearby sources is presented in Table C2. The three most recent years available of actual reported $PM_{2.5}$ emissions for each nearby source was retrieved to inform the determination of which nearby sources will need to be explicitly modeled.

Table C2. Table of stationary point sources within the modeling domain for the multi-source situation

Facility Number	Facility Type	Actual $PM_{2.5}$ Emissions Reported [tons / year]		
		2020	2021	2022
1	Cut Stock, Resawing Lumber, and Planing	24.8	22.5	23.7
2	Fossil Fuel Electric Power Generation	2.3	3.1	9.9
3	Solid Waste Landfill	1.7	1.9	2.2
4	Pipeline Transportation of Natural Gas	1.2	1.2	1.3
5	Cut Stone and Stone Product Manufacturing	16.2	16.3	16.6
6	Cut Stone and Stone Product Manufacturing	2.8	2.6	2.6
7	Sawmill	32.4	45.8	51.2
8	Electric Power Generation	67.3	70.3	67.8
9	Cut Stock, Resawing Lumber, and Planing	3.0	3.3	3.1
10	Reconstituted Wood Product Manufacturing	101.1	118.9	93.6
11	Solid Waste Landfill	0.2	0.4	0.3
12	Other Electric Power Generation	15.0	13.2	9.9
13	Plastics Material and Resin Manufacturing	0.1	0.1	0.1
14	Solid Waste Landfill	0.3	1.2	2.1
15	Tire Manufacturing	4.6	5.4	5.0

3. Determining representativeness of ambient monitor data

Of the three monitors presented in Table C1, monitor 1 is located in a dispersion environment most like the location of the hypothetical source. Additionally, monitor 1 is located in the vicinity of a number of permitted sources located to the west of the monitor that may also directly impact the air quality at the location of the hypothetical source. Monitor 2 is in the vicinity of nearby source number 5 but this monitor is a neighborhood scale monitor and therefore may not be representative of the background concentration at the location of the hypothetical source. Monitor 3 on the other hand is not in the vicinity of any large, stationary point sources but is located in the downtown area of the large metropolitan city and therefore is representative of an urban source mix that differs from the location of the hypothetical source. All three monitors have nearly the same 2023 design value which means the broader dispersion environment is well-mixed and there are not large concentration gradients present within this area. Therefore, based on proximity and similar land use patterns, monitor 1 has been selected to represent the monitored background concentration for $PM_{2.5}$.

To determine how representative monitor 1 is of the hypothetical source location, we must consider the source mix in the vicinity of the monitor. There are five nearby sources located within 10 to 15 km of monitor 1. The five sources include sources 1, 9, 10, 11, and 12. These sources are located to the west and northwest of the monitor and therefore are not located in the predominate downwind directions of the monitor. However, given this modeling is for an annual averaging period, it is possible that the impacts of these five sources are well-mixed and represented in the 2023 design value of 8.3 $\mu g/m^3$. Despite the proximity to the monitor, source 10 should be further considered for explicit modeling considering it reported emission rates near

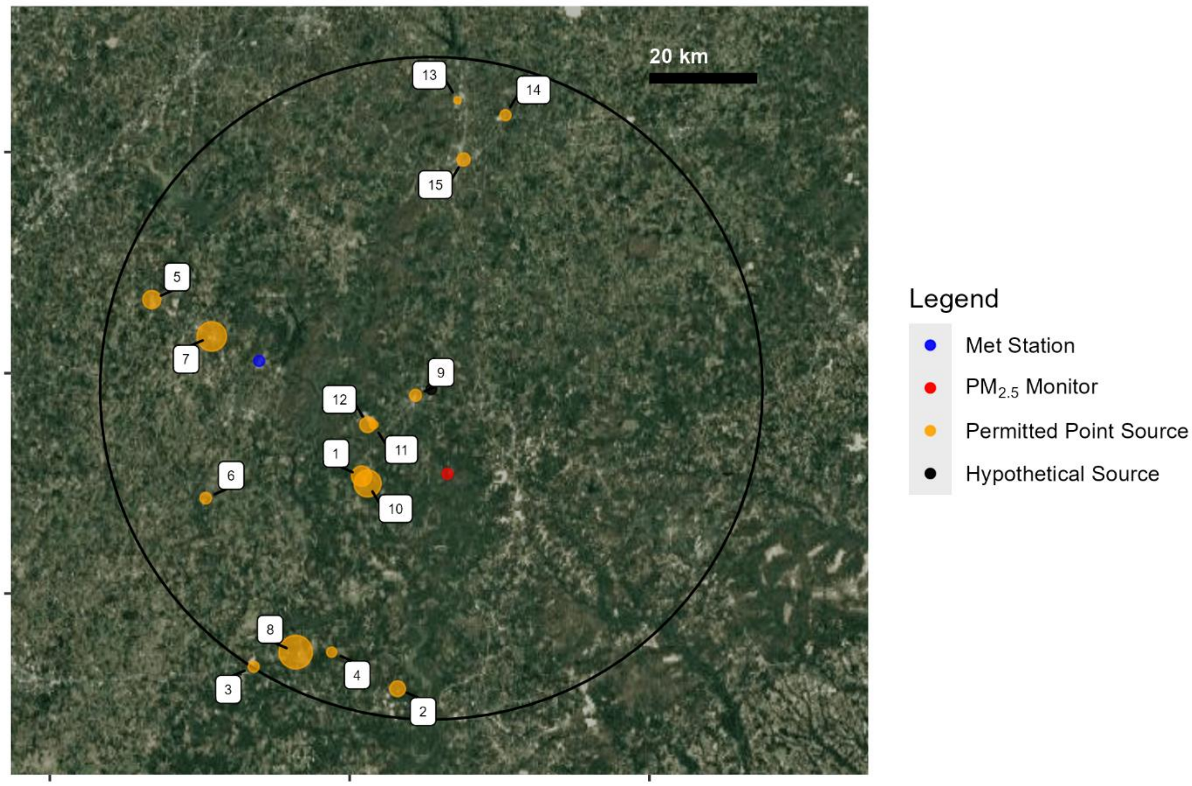
100 tons per year between 2020 and 2022. The other four sources all have reported emission rates less than 25 tons per year and are likely represented in the selected background monitor.

An additional set of nearby sources that may be adequately represented by monitor 1 would be the four sources located to the southwest of the monitor. These four sources include sources numbered 2, 3, 4, and 8. Considering one of the predominate wind directions is from the south-southwest, it is possible the lower emitting sources in this area are represented by monitor 1. However, source 8 reported an average emission rate of 68 tons per year between 2020 and 2022 which may not be adequately represented by the background monitor considering this higher emission rate relative to those of the other 15 nearby facilities. The two other clusters of sources located to the west and north of monitor 1 (i.e., 5, 6, and 7; and 13, 14, and 15) may not be adequately represented by the monitor due to their locations being outside of the predominate wind directions and distance from the monitor. Therefore, based on these observations from the available data, there are eight sources (5, 6, 7, 8, 10, 13, 14, and 15) that will need to be further assessed to determine whether they should be explicitly modeled in the cumulative impact analysis.

4. Determination of Nearby Sources to Explicitly Model

Step 3 of the framework identified eight sources (5, 6, 7, 8, 10, 13, 14, and 15) that should be considered for explicit modeling. To further assess these sources, Figure C4 maps the nearby sources with the points weighted to represent the average reported $PM_{2.5}$ emission rates in tons per year between 2020 and 2022. Based on this map and the reported emissions in Table C2, the 3 nearby sources (13, 14, and 15) located to the north of the hypothetical source and the selected representative monitor (i.e., monitor 1) have all reported emissions less than 5 tons per year. These reported emissions are relatively low compared to the other 100 ton per year sources in the area and likely accounted for in the general background levels at monitor 1 so not deemed necessary to explicitly model here. Nearby sources 5 and 6 also have reported emissions under 20 tons per year and should be left out of explicit modeling for the same reason as stated above.

Figure C4. Map of nearby sources with points weighted by average reported emissions between 2020 and 2022 in tons per year[30]



Sources 7, 8, and 10 have the highest reported emissions in the area and it is unclear whether these nearby sources are adequately represented by the selected background monitor (i.e., monitor 1). Source 7 is not located within the primary wind directions (i.e., winds from the northeast or southwest) of the selected monitor or the hypothetical source. Additionally, wind speeds across the project area are calm, with 44.5% of measurements less than 1 meter per second across the 3 years plotted in Figure C2. Therefore, it is unlikely that emissions from this

[30] The source labels in Figure C4 correspond to the source number in Table C2.

source will impact the location of the hypothetical source and the hypothetical source's impacts are unlikely to cause an impact in the area of nearby source 7.

Source 8 is the next largest emitter in the area and is located both upwind and downwind of monitor 1 and the hypothetical source location depending on the primary wind direction. This nearby source is located 45 km from the hypothetical source location. To decide whether to explicitly model this source, we will assess modeling information available from a similar electric power generation facility which has reported similar emission rates as nearby source 8. Results from the single source impact analysis of this similar source are plotted in Figure C5. This source is also located in a rural area; however, it is located along a river valley which affects the wind patterns in this area. The wind rose from the area's meteorological monitor is shown in Figure C6 and shows that the wind patterns generally align with the river valley. The maximum concentration impacts from the similar electric power generation facility are located within 5 km of the facility, while elevated concentration impacts span approximately 20 km to the south of the facility and 15 km to the north. Wind speeds at the similar source are greater than those measured in the hypothetical project area; therefore, impacts from source 8 should not disperse as far as the concentration impacts seen in Figure C5. However, if source 8 emissions were to disperse 10 to 15 km, these concentration impacts may overlap with those of source 10 which is the largest emitting source in the project area. Therefore, source 8 should be explicitly modeled as a result of its location and potential concentration impacts in the vicinity of the hypothetical source.

Finally, source 10 is located within the first 10 to 20 km of the hypothetical source and is located directly upwind. Considering this source's proximity and that this source has the largest reported emission rates of the nearby sources in the project area, this source should be explicitly modeled. Therefore, out of the 15 nearby sources located within the 50 km modeling domain, two of those sources (i.e., 8 and 10) should be explicitly modeled in the cumulative modeling demonstration.

Figure C5. $PM_{2.5}$ concentrations from an existing single source impact analysis for an electric power generation facility similar in size and operation to nearby source 8

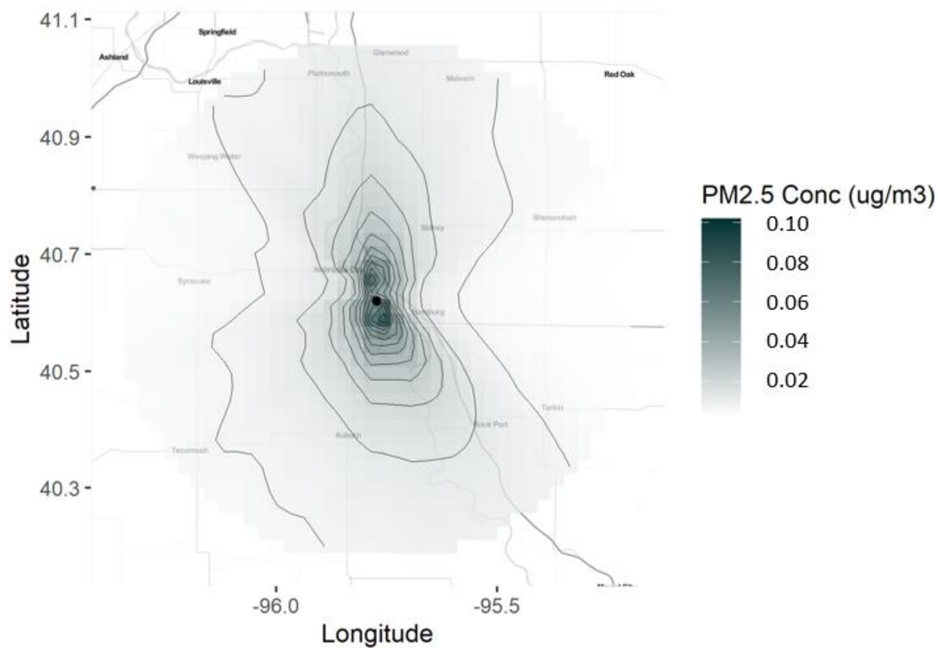
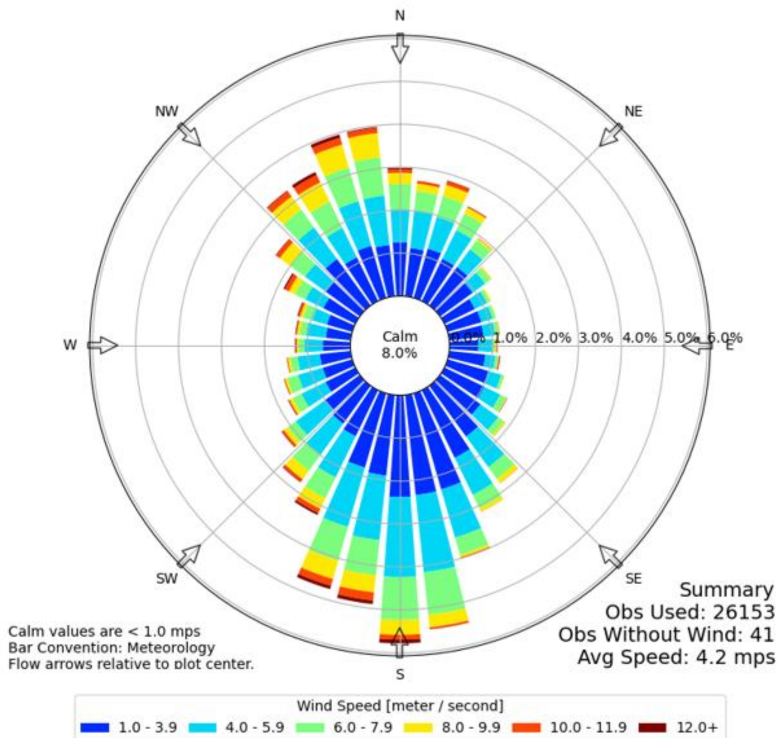


Figure C6. Wind rose of meteorological data collected near the similar electric power generation facility between 2021 and 2023



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