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Project-Level Air Quality Handbook

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1.0 INTRODUCTION

This *Project-Level Air Quality Handbook* (Handbook) is intended to assist the Pennsylvania Department of Transportation (PennDOT), its consultants, and other potential users in the completion of project-level mobile source air quality analyses to satisfy current state and federal air quality requirements for transportation improvement projects. In addition, the Handbook provides the framework to complete project-level greenhouse gas (GHG) emission and climate change assessments. The project-level air quality analyses occur as part of the National Environmental Policy Act (NEPA) evaluation process and address requirements in the Clean Air Act.

In general, PennDOT applies the policies discussed in this Handbook to projects that receive federal funding and to 100 percent state funded projects. PennDOT reserves the right to deviate from this approach, if circumstances warrant.

This Handbook contains technical language and will best assist those who have a basic knowledge of transportation, air quality, and climate change policies. The guidance and procedures provided herein should be referenced during the project scoping and analysis phases of the transportation development process. These procedures are not an adjudication or regulation. There is no intent on the part of PennDOT to give the procedures in this guidance reference weight or deference. This document establishes the framework within which PennDOT will exercise its administrative discretion in the future. PennDOT reserves the discretion to deviate from this document if circumstances warrant. This guidance is not regulatory.

The Handbook provides:

- A process to analyze and report air quality impacts of transportation improvement projects;
- Background information and citations to relevant state and federal rules, regulations, and guidance documents;
- A screening process to identify projects that may be of air quality concern and a process to determine the need and level of air quality modeling during the NEPA process;
- Technical guidance and procedures on modeling carbon monoxide (CO) at the project-level;
- Technical guidance and procedures for assessing particulate matter less than 2.5 microns in size ($PM_{2.5}$) and particulate matter less than 10 microns in size (PM_{10}) at the project-level;
- Technical guidance and procedures for assessing Mobile Source Air Toxics (MSATs) at the project-level;
- Guidance on documenting regional conformity analysis for NEPA documentation; and,
- Methods to consider GHG emissions and climate change impacts within the project planning process.

These guidelines supersede PennDOT *Publication 321: PennDOT Project-Level Air Quality Handbook*, dated December 2015. Revisions to the previous policy were necessary to bring the guidelines up guidelines up to date with current air quality regulations and recent federal guidance. This Handbook incorporates all pertinent issues relating to air quality, GHG emissions, and climate change at a project-level in Pennsylvania. An electronic copy of the Handbook can be found at following web link: https://www.pa.gov/content/dam/copapwppagov/en/penndot/documents/public/pubsforms/publications/pub%20321.pdf. This Handbook will be updated on an as needed basis.

It is PennDOT's policy to assess the air quality impacts of transportation improvement projects and to give consideration to the incorporation of appropriate avoidance and/or relief strategies into preliminary engineering designs and construction for those highway projects that have potential air quality impacts. These guidelines are in compliance with Title 23 CFR Part 771, and also reflect recent procedures regarding conformity as promulgated by the United States Environmental Protection Agency (EPA) as of April 2012, (Final Conformity Rule 40 CFR, Parts 51 and 93). PennDOT's policy is to follow regulations issued by EPA, the Federal Highway Administration (FHWA), and the Pennsylvania Department of Environmental Protection (PDAEP). In addition, PennDOT is providing a framework for GHG emission and climate change assessments within NEPA studies.

1.1 Organization

This Handbook is organized into five sections and three appendices. They include:

- **Section 1.0 (Introduction)** provides an overview and background information for the Handbook;
- **Section 2.0 (CO Project-level Analyses)** provides guidance relevant to the specific procedures to be employed when undertaking micro-scale modeling for CO;
- **Section 3.0 (PM Project-level Analyses)** provides guidance relevant to the specific procedures for the $PM_{2.5}$ and PM_{10} hot-spot project screening process;
- **Section 4.0 (MSATs Project-level Analyses)** provides summary of FHWA guidance on the project-level analysis of MSATs for transportation projects;
- **Section 5.0 (Regional Conformity Documentation)** provides information regarding project relevant documentation of regional conformity analyses;
- **Section 6.0 (Reporting Requirements for Project-Level Air Quality)** discusses key NEPA documentation and the format and data for air quality technical reports;
- **Section 7.0 (GHG Emissions/Climate Change Project-Level Analysis and Documentation)** discusses GHG emissions and climate change assessments;
- **Appendix 1** is the ***PM Project-level Conformity Level 3 Screening Template***;
- **Appendix 2** is the ***GHG Emission and Climate Change Evaluation Template;***
- **Appendix 3** provides a complete ***Glossary of Common Terms and Acronyms***; and
- **Appendix 4** ***Document Reference Guide*** provides hyper-links to federal and state guidance documents relative to transportation air quality and climate change issues.

1.2 Background

1.2.1 Regional Conformity

The EPA established standards for a number of air pollutants in the Clean Air Act (CAA), Public Law 101-549. The CAA has established specific procedures and limitations for evaluating transportation projects in regions of the United States, called non-attainment or maintenance areas that have not met these standards. The specific procedures, often referred to as conformity regulations, are outlined in 42 U.S.C. Part 7401 and are further detailed in federal regulations (40 CFR Parts 51 and 93). Conformity regulations require PennDOT to assess the potential air quality

impacts of all regionally significant planned and programmed transportation projects on the natural and human environment.

1.2.2 Project-Level Air Quality

In addition to the conformity regulation requirements referenced above, NEPA and Pennsylvania Act 120 are the federal and state acts requiring environmental review of actions that have the potential to affect the environment. Specifically, transportation projects using federal-aid funds and/or requiring FHWA approval actions must be evaluated for the potential impacts the actions will have on the natural and human environment. Air quality is one of several elements within the human environment to be considered as part of a NEPA/Pennsylvania Act 120 evaluation. The NEPA requirements in regard to project-level air quality analysis are outlined in 23 Code of Federal Regulations (CFR), Part 771. FHWA provides additional guidance for completing highway-related air quality studies in the following document: Technical Advisory T 6640.8A, Guidance for Preparing and Processing Environmental and Section 4(f) Documents, dated October 30, 1987, located online at https://www.environment.fhwa.dot.gov/legislation/nepa/guidance_preparing_env_documents.aspx

The major difference between the project-level air quality requirements under the CAA and those under the NEPA is that CAA hot-spot requirements apply to projects within specifically identified areas (nonattainment/maintenance areas), whereas NEPA applies to federally funded projects regardless of location.

1.2.3 GHG Emissions/Climate Change

Within the NEPA context described above, PennDOT has established a framework to address climate change and greenhouse gas (GHG) emissions. This framework includes a GHG emissions analysis as a proxy for the project's impact to climate change and an assessment of the effects climate change may have on the proposed action and its environmental impacts considering available research and data.

1.3 Air Quality Pollutants and Regulations

EPA established National Ambient Air Quality Standards (NAAQS) for commonly found air pollutants, called criteria pollutants, in the CAA and 1990 Clean Air Act Amendments (CAAA). The seven criteria pollutants are CO, ozone, $PM_{2.5}$, PM_{10}, nitrogen oxides (NO_x), sulfur dioxide (SO_2), and lead. A number of these pollutants, such as CO, PM, ozone, and NO_x are caused by transportation-related sources and are a concern to human health and the environment. In particular:

Web link to EPA's latest NAAQS:
https://www.epa.gov/criteria-air-pollutants/naaqs-table

- CO is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, which contributes approximately 56 percent of all carbon emissions nationally. CO is affected by variations in temperature and vehicle speeds.
- PM is a term used to describe particles in the air including dust, dirt, soot, smoke, and liquid droplets. Sources that directly emit PM include motor vehicles, construction activities, and unpaved roads. Sources of particles that form in the air from chemical processes involving sunlight and water vapor include fuel combustion in motor vehicles and at power plants and industrial processes.

PM_{10} is used as a measure of *coarse* particulate, in which the particles are 10 microns or less in size. Coarse particles of this size are typically formed by earth-based materials such as construction and re-entrained road dust and brake and tire wear. $PM_{2.5}$ is used as a measure of *fine* particulate, in which the particles are 2.5 microns or less in size. Fine particles of this size are typically, but not exclusively, formed as a product of combustion.

- Ozone (i.e., ground-level photochemical smog) is different from CO and PM in that it results from a chemical reaction between volatile organic compounds and oxides of nitrogen in the presence of sunlight. Also, the concentration and dispersion of ozone are significantly affected by an area's meteorology and topography. Because it is primarily an area wide pollutant, it is typically assessed in system-level planning as part of the air quality State Implementation Plan (SIP) development and conformity process. Through the Transportation Improvements Program (TIP)/SIP evaluation process, this pollutant is evaluated on a regional level, but is not a concern as a *hot-spot* pollutant.
- NO_x are a group of highly reactive gases. One of these gases, nitrogen dioxide (NO_2), along with particles in the air, is often seen as a reddish-brown layer over urban areas. The primary sources of NO_x emissions are motor vehicles, electric utilities, and industrial, commercial, and residential sources that burn fuel. NO_x are considered an ozone precursor and are evaluated as part of the regional conformity requirements during the project planning phases, and has not been a pollutant of concern for project-level analyses.

Criteria air pollutants are called such because EPA has set standards to limit them based on human health based and/or environmentally based data. Primary standards set maximum limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards are set to protect public welfare and the environment, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings. With the exception of sulfur dioxide, all criteria pollutants have secondary standards that are equal to the primary standards. The criteria pollutants and their NAAQS are displayed in **Table 1**. Units of measure for the standards are parts per million (ppm) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$).

The CAA requires EPA to periodically review each NAAQS for potential update and revision, and as such they may be revised. Users must consult EPA resources (e.g. website, guidance, etc.) for pollutants, air quality standards, and the nonattainment status of a particular area prior to evaluating the air quality analysis needs for a particular project.

In addition, other transportation-related pollutants of concern, which are not criteria pollutants, include Mobile Source Air Toxics (MSATs). Air toxics, often called hazardous air pollutants, are pollutants known to cause cancer, other serious health effects, or adverse environmental effects. Air toxics can be from a variety of sources including automobiles. In addition to the NAAQS pollutants, EPA regulates MSATs. Nine of the MSATs, 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter are considered priority MSATs. EPA has yet to establish regulatory concentration targets for these nine MSATs.

Greenhouse gases (GHG) are a group of compounds that are able to trap heat in the atmosphere, keeping the Earth's surface warmer than it would be if they were not present. Sources for GHG emissions, both direct and indirect, are typically evaluated globally or per broad scale sector (e.g., transportation, industrial, etc.) and not assessed at the project level. To date, no national standards have been established regarding GHGs, nor has the EPA established criteria or thresholds for ambient GHG emissions. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their impacts on climate, including reports from the Intergovernmental Panel on Climate Change (IPCC), the National Academy of Sciences, EPA, and other federal agencies.

Table 1: Criteria Pollutant NAAQS

(as of October 2015: Source: https://www.epa.gov/criteria-air-pollutants/naaqs-table)

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month average	0.15 µg/m3 (1)	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	Annual	53 ppb (2)	Annual Mean
Ozone [80 FR 65292, Oct 26, 2015]		primary and secondary	8-hour	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution [78 FR 3085 Jan 15, 2013]	PM2.5	primary	Annual	12 µg/m^3	annual mean, averaged over 3 years
		secondary	Annual	15 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM10	primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

(2) The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

1.4 Requirements of PennDOT and its Consultants

NEPA and Pennsylvania Act 120 are the federal and state acts requiring environmental review of actions that have the potential to affect the environment. The CAA and the Pennsylvania Air Pollution Act are federal and state acts relating to air quality. Specifically, transportation projects using federal-aid funds and/or requiring FHWA approval actions must be evaluated for the potential impacts the actions will have on air quality. Air quality analyses may be conducted at the regional and project-level depending on the characteristics of the project and the attainment status for the project location. Ozone and $PM_{2.5}$ are evaluated as part of the regional conformity analyses as applied to the TIP and Long-Range Transportation Plan (LRTP) process.

Pennsylvania currently has nonattainment and maintenance areas for the ozone and $PM_{2.5}$ NAAQS. $PM_{2.5}$ (in addition to regional areas in EPA's Greenbook: https://www.epa.gov/green-book application), CO, and MSATS are typically addressed at the project-level within the NEPA process. In addition, to those pollutants, GHG and climate change are other considerations that should be considered within NEPA. The project-level air quality and climate assessments required during Pennsylvania's NEPA process will vary considerably in content and in level of detail from one project to another based on its size, geographic location, meteorological conditions, and anticipated impacts.

1.4.1 Regional Conformity

Pennsylvania nonattainment and maintenance areas are required to undergo regional macro-scale modeling, often called a regional conformity analysis. A conformity analysis is ultimately a way to ensure that federal funding and approval are only given to those transportation activities (in nonattainment and maintenance areas) that are consistent with regional, statewide, and national objectives. The detailed conformity regulations specify the analysis methodology and timing necessary for a regional conformity determination. These analyses are conducted separate from the NEPA evaluation process and are not specifically covered within this Handbook. However, the NEPA process does require documentation addressing the completion of a regional conformity analysis. A detailed discussion of these requirements within the NEPA process can be found in **Section 5** of this report.

1.4.2 CO Project-level Analyses

NEPA project air quality analyses have typically focused on CO as the primary indicator for vehicular induced pollution. A CO project-level air quality analysis is performed to ensure that new or worsened violations of the NAAQS will not occur as a result of the proposed project. Recent trends in air quality indicate CO levels throughout Pennsylvania have dramatically improved over the last decade, as demonstrated by the attainment status for CO throughout the state. Although project-level analyses will likely continue to evaluate CO levels associated with transportation improvement projects, PennDOT has developed thresholds used to determine whether a quantitative CO analysis is required for an individual project. In addition, FHWA has developed a CO categorical hot spot finding. Project sponsors may be able to rely on the categorical hot-spot finding in place of doing their own CO hot-spot analysis as part of a project-level conformity determination. A detailed discussion of CO project-level screening and analyses can be found in **Section 2** of this report.

1.4.3 PM Project-level Analyses

On March 10, 2006, EPA published a final rule establishing transportation conformity requirements for analyzing the local PM air quality impacts of transportation projects (71FR 12468) in PM nonattainment or maintenance areas. Beginning December 20, 2012, a quantitative PM hot-spot

analysis using EPA's MOVES emission model is required for those projects that are identified as *projects of local air quality concern* per an established interagency consultation process.

FHWA/FTA projects must be found to conform before they are adopted, accepted, approved, or funded. Conformity must be redetermined for any FHWA/FTA project if one of the following occurs: a significant change in the project's design concept and scope; three years elapse since the most recent major step to advance the project; or initiation of a supplemental environmental document for air quality purposes. Major steps include NEPA process completion; start of final design; acquisition of a significant portion of the right-of-way; and construction (including Federal approval of plans, specifications and estimates). (40 CFR 93.104(d)).

Direct emissions from combustion are of primary concern for project-level analyses, but in some cases re-entrained road dust and emissions from long term construction activities may require analysis. A detailed discussion of PM project-level analyses can be found in **Section 3** of this report.

1.4.4 Mobile Source Air Toxics Project-level Analyses

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA. Nonetheless, air toxics concerns continue to be raised on highway projects during the NEPA process. Even as the science emerges, we are duly expected by the public and other agencies to address MSAT impacts in our environmental documents. The FHWA has outlined a tiered approach for analyzing MSATs in NEPA documents, with three tiers representing the levels of potential impacts from projects. A detailed discussion of MSAT project-level analyses can be found in **Section 4** of this report.

1.4.5 GHG Analysis/Climate Change

Similar to an air toxics analysis, appropriate techniques and methodologies to assess GHG and climate change continue to evolve. PennDOT has developed a process to disclose the potential impact of transportation project alternatives on GHG emissions. In addition, considerations of a changing climate should also be considered within the NEPA process. Increased temperatures and/or more severe precipitation events are examples of climate stressors that may affect the evaluation and assessment of project alternatives. A detailed discussion of GHG and climate change analyses can be found in **Section 7** of this report.

1.5 Identification of Projects Requiring an Air Quality Assessment

The type and characteristics of transportation projects determine whether they are included in regional emissions analyses or require an individual project-level air quality assessment. There are several key categories of projects that affect the level of analysis and NEPA documentation. These include exempt projects and non-exempt projects, which may or may not be of air quality concern.

1.5.1 Exempt Projects

Exempt projects are project types that typically will not have a significant impact on air quality. These include a variety of safety improvements, roadway maintenance and resurfacing, bridge rehabilitation, and roadway landscaping activities. **Table 2** illustrates projects that are exempt from both regional and project-level air quality analyses according to the federal conformity regulations. The conformity rule provides additional projects that are only exempt from regional transportation conformity determinations, as illustrated in **Table 3**. Exempt projects do not require air quality analyses.

1.5.2 Non-Exempt Projects

Projects that are not exempt according to the federal conformity regulations are evaluated to determine whether they are considered of air quality concern. For regional conformity analyses, this process includes consultation between the local planning organizations, PennDOT Central and District offices, PADEP, EPA, FHWA, and FTA (if applicable). A consensus decision is determined to identify *air quality significant projects*. Non-exempt projects that are determined not to be of air quality significance are excluded from the regional emission analyses. These may include certain transportation control measures (TCMs) and capacity improvement projects focusing on lower-classification roadways.

At the project-level, individual project decisions are made based on an evaluation of project characteristics including traffic volumes, truck percentages and current congestion levels. The screening process and key decision thresholds are discussed in the detailed project-level sections for CO, PM and MSATs within this Handbook. Project-level PM analyses are guided by federal conformity regulations and include a multi-level decision framework that includes interagency consultation for select projects. Decisions focus on determining what transportation projects are of air quality concern, thus requiring detailed quantitative analyses.

1.6 Project Construction Emissions

Air quality impacts resulting from roadway construction activities are typically not a concern when contractors utilize appropriate control measures. In Pennsylvania, contractors shall perform all construction activities / operations in accordance with 25 Pa. Code Article III (Chapters 121-145, Air Resources) to ensure adequate control measures are in place. In the event of a unique project situation or public controversy, the agency / consultant should consult the PennDOT EPDD.

Section 93.123(c) of the conformity rule includes the general requirements for all PM hot-spot analyses. According to the rule, a PM hot-spot analysis must consider emission increases from construction-related activities only if they occur during the construction phase and last more than five years at any individual site. If such analyses are warranted, the EPA guidance for PM quantitative hot-spot analyses (as discussed in **Section 3.0**) provides the methods and procedures for estimating emissions from construction.

1.7 Identification of Projects Requiring GHG/Climate Change Assessments

PennDOT has developed scoping guidelines and methods for addressing GHG emissions and climate change impacts on the transportation system. GHG emission analyses (either quantitative or qualitative) are limited to those projects that are anticipated to have significant transportation and/or construction impacts. The emission analyses are intended to disclose the potential GHG impacts of the project and may be used as a criteria to evaluate project alternatives. Climate change effects should consider both the impacts of climate change on the proposed project as well as the effects on the affected environment,

particularly resources potentially impacted by the project that may also be affected by climate change. PennDOT recommends a qualitative assessment of climate change effects utilizing resources and data that are readily available.

The complexity and level of detail of the NEPA documentation will be commensurate with the degree of analyses completed for the project (i.e., qualitative vs. quantitative). These analysis types are discussed in **Section 7**.

Table 2: Projects Exempt from Project-level and Regional Conformity Analyses
Source: Table 2 40 CFR 93.126

SAFETY	
• Railroad/Highway crossing; • Hazard elimination program; • Safer non-Federal-aid system roads; • Shoulder improvements; • Increasing sight distance; • Safety improvement program; • Traffic control devices and operating assistance other than signalization projects; • Railroad/highway crossing warning devices; • Guardrails, median barriers, crash cushions; • Emergency truck pullovers	Pavement resurfacing and/or rehabilitation; Pavement marking demonstration; Emergency relief (23 U.S.C. 125); Fencing; Skid treatments; Safety roadside rest areas; Adding medians; Truck climbing lanes outside the urbanized area; Lighting improvements; Widening narrow pavements or reconstructing bridges* (no additional travel lanes);
MASS TRANSIT	
• Operating assistance to transit agencies. • Purchase of support vehicles; • Rehabilitation of transit vehicles [1] • Purchase of office, shop, and operating equipment for existing facilities; • Purchase of operating equipment for vehicles (e.g., radios, fareboxes, lifts, etc.); • Construction or renovation of power, signal, and communications systems; • Construction of small passenger shelters and information kiosks;	• Reconstruction or renovation of transit buildings and structures (e.g., rail or bus buildings, storage and maintenance facilities, stations, terminals, and ancillary structures); • Rehabilitation or reconstruction of track structures, track, and track bed in existing rights-of-way; • Purchase of new buses and rail cars to re-place existing vehicles or for minor expansions of the fleet [1]; • Construction of new bus or rail storage/maintenance facilities categorically excluded in 23 CFR part 771.
AIR QUALITY	
• Continuation of ride-sharing and van-pooling promotion activities at current levels.	• Bicycle and pedestrian facilities.
OTHER	
• Specific activities which do not involve or lead directly to construction, such as: Planning and technical studies, Grants for training and research programs. Planning activities conducted pursuant to titles 23 and 49 U.S.C., Federal-aid systems revisions. • Engineering to assess social, economic, and environmental effects of the proposed action or alternatives to that action. • Noise attenuation.	• Emergency or hardship advance land acquisitions (23 CFR 710.503); • Acquisition of scenic easements; • Plantings, landscaping, etc.; • Sign removal; • Directional and informational signs; • Transportation enhancement activities (except rehabilitation and operation of historic transportation buildings, structures, or facilities); • Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, location or capacity changes.

(1) In $PM_{2.5}$/ PM_{10} nonattainment or maintenance areas, such projects are exempt only if they are in compliance with control measures in the applicable implementation plan.

** Additional Note: Bridge reconstruction would also include bridge rehabilitation and/or replacement*

Table 3: Additional Projects Exempt from Regional Level Conformity Only Source: Table 3 40 CFR 93.127

Intersection channelization projects.
Intersection signalization projects at individual intersections.
Interchange reconfiguration projects.
Changes in vertical and horizontal alignment.
Truck size and weight inspection stations.
Bus terminals and transfer points.

1.8 Supporting Agencies and Organizations

In Pennsylvania, there are a number of agencies and organizations that are involved in regional and project level air quality processes. These include:

- PennDOT – This includes both the Central Office and Districts. The PennDOT offices are involved with the administration and review of project-level analyses as well as the regional conformity requirements in non-attainment and maintenance areas throughout the state.

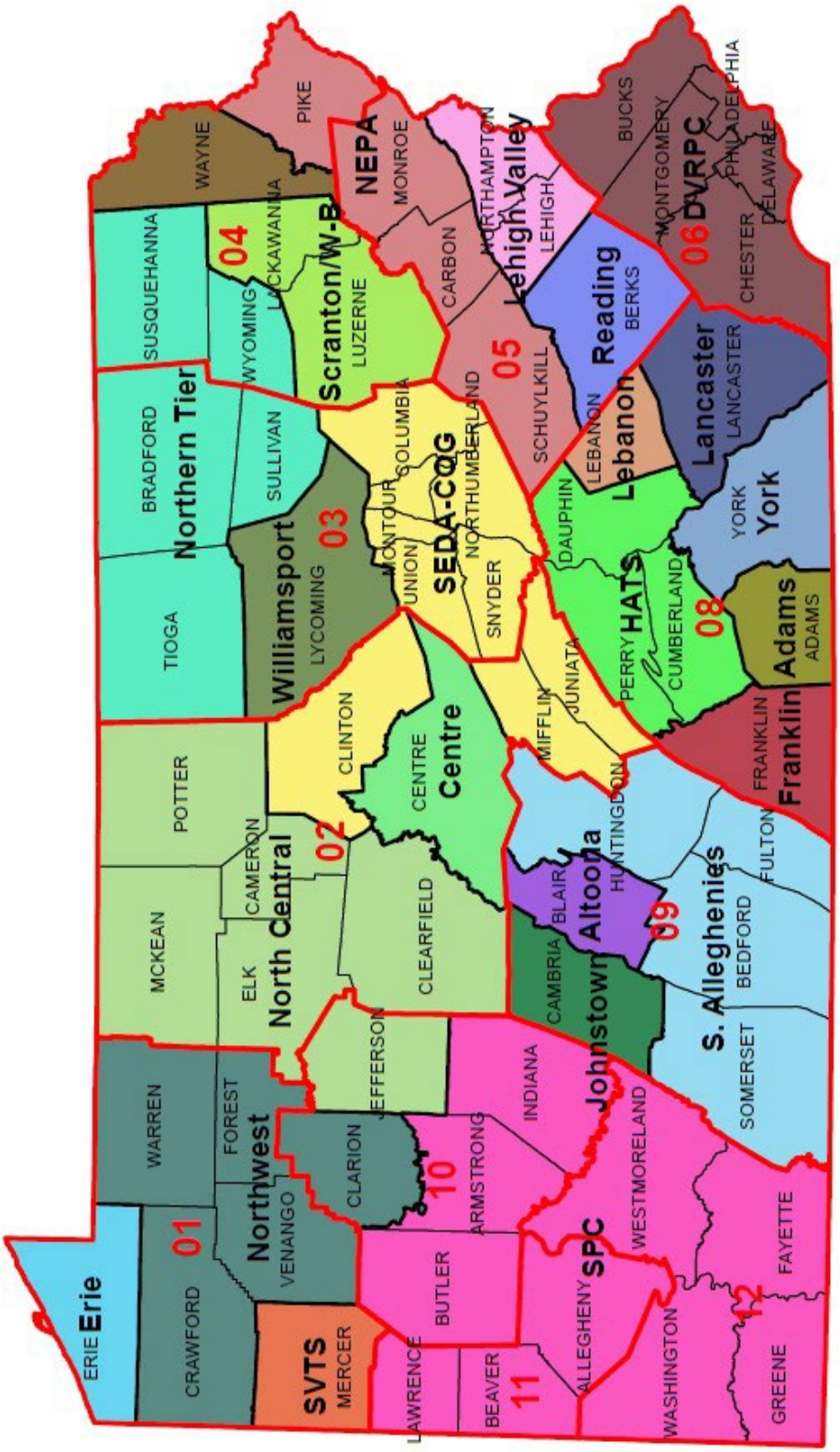
- FHWA/Federal Transit Administration (FTA) – FHWA and FTA (if applicable) provide key federal approvals and review for all regional and project-level air quality assessments. They are also consulted for decisions determining whether projects are of air quality concern.

- EPA – EPA is consulted throughout the process including consultation on projects of air quality concern and the methods and data used for performing a quantitative PM hot-spot analysis.

- Metropolitan Planning Organizations (MPOs) and Rural Planning Organizations (RPOs) – MPOs are responsible for regional conformity requirements of non-attainment and maintenance areas that are within their MPO boundaries. Urban MPOs that have performed their own regional conformity analyses include Allentown (LVPC), Reading Area Transportation Study (RATS), Harrisburg (HATS), Lancaster County (LCPC), Philadelphia (DVRPC), Pittsburgh (SPC) and York County (YCPC). PennDOT performs emissions analyses on the behalf of other MPOs and non-urbanized areas (RPOs) that contain nonattainment or maintenance areas. As discussed in **Section 5.0**, EPA's current online resources should be consulted to determine the latest non-attainment and maintenance area designations. **Figure 1** illustrates Pennsylvania's MPO/RPO boundaries. Specific contacts for each of the planning agencies can be obtained from the following web link: https://www.pa.gov/agencies/penndot/contact-us.html#sortCriteria=relevancy%2C%40copapwptitle%20ascending&f-copapwpcontacttype=Metropolitan%20and%20Rural%20Planning%20Orgs

- Pennsylvania Air Quality Working Group – Interagency consultation is an important component of the conformity requirements. In Pennsylvania, an interagency consultation group has been established to provide review and consultation on regional and project-level air quality issues. This includes the identification of regionally air quality significant projects, review of air quality assumptions and methods, and assessment of projects requiring project-level quantitative analyses. This group consists of the representatives from urban MPOs, PennDOT (representing all other MPOs and RPOs), FHWA, FTA, PADEP, and EPA.

Figure 1: PennDOT District and MPO/RPO Planning Agency Boundaries



1.9 PennDOT Support and Review

Two (2) hard copied and an electronic copy of the air quality report(s) must be provided to PennDOT Central Office, Chief of Environmental and Policy Development Division for preliminary and final review. Copies of all CO, $PM_{2.5}$ (and or PM_{10}) and MSATS input and output data from EPA-approved emissions factor and dispersion models must be included. The PennDOT Engineering District and consultant performing the analyses must also retain copied of the plans, traffic, air quality models and all other related information. The agency/consultant performing the analyses must also maintain copies of the plans, traffic, air quality reports, and documentation in accordance with the contract.

Key Contact for Support/Review:

Chief of Environmental Policy and Development Division

Bureau of Design and Delivery
Pennsylvania Department of Transportation
Commonwealth Keystone Building
400 North Street, 7th Floor
Harrisburg, Pennsylvania 17120

PH: 717-705-1481

Should a separate technical report be required to address GHG and climate change, two (2) hard copied and an electronic copy must also be provided to the PennDOT Central Office.

Any questions or comments about the guidance provided in this document should be directed to the Environmental Policy and Development Division (EPDD) within PennDOT's Bureau of Design & Delivery.

2.0 CARBON MONOXIDE (CO) PROJECT-LEVEL ANALYSES

CO is a colorless, odorless gas that is formed when carbon in fuel is not burned completely and is a component of motor vehicle exhaust. CO is sensitive to variations in temperature and vehicle speed. NEPA project air quality analyses have typically focused on CO as the primary indicator for vehicular induced pollution. A CO project-level air quality analysis is performed to ensure that new or worsened violations of the NAAQS will not occur as a result of the proposed project. Recent trends in air quality indicate CO levels throughout Pennsylvania have dramatically improved over the last decade, as demonstrated by the attainment status for CO throughout the state. To limit unnecessary analyses, PennDOT has developed thresholds to determine whether a quantitative CO analysis is required for an individual project. The NEPA documentation will require an assessment of the level of analysis, a qualitative overview of potential emission impacts, and a quantitative analysis, if applicable.

2.1 Level of Analysis

A project assessment for CO is conducted to determine the appropriate level of analysis (qualitative or quantitative) to meet all applicable regulatory requirements. A qualitative analysis provides a brief narrative indicating the project's limited impact on air quality. A quantitative assessment involves a CO modeling analysis utilizing emission factors from EPA's approved emission factor model.

Determining the appropriate level of analysis generally includes an evaluation of qualifying exemptions provided in the federal conformity rule, comparisons to available categorical findings if available, and evaluation to traffic and congestion thresholds developed by PennDOT in coordination with federal partners. These assessment options are reviewed below with corresponding data and information sources that may be applied in support of their application.

2.1.1 Exemptions

Any and all exemptions provided in the federal transportation conformity rule and its future updates may be applied as appropriate for a project. **Table 2** provides a list of project types that are considered insignificant from an air quality perspective. These project types require only a qualitative analysis.

2.1.2 Categorical Findings

The federal transportation conformity rule at 40 CFR 93.123(a)(3) [1] provides an option for the US DOT, in consultation with EPA, to make a categorical hot-spot finding for CO based on appropriate modeling. FHWA's website should be consulted to determine available findings. https://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/cmcf_2017/hotspot_finding.cfm

Available categorical findings for CO can be applied as appropriate for projects located in Pennsylvania. The data and forecasts needed to apply a categorical finding are generally a subset of the detailed information that would otherwise be needed to conduct projects specific modeling. This typically includes estimated traffic volumes, intersection configurations, and level-of-service

[1] See https://www.govinfo.gov/content/pkg/CFR-2011-title40-vol20/xml/CFR-2011-title40-vol20-sec93-123.xml Excerpt for CO (40 CFR 93.123(a)(3)): *DOT, in consultation with EPA, may also choose to make a categorical hot-spot finding that (93.116(a) is met without further hot-spot analysis for any project described in paragraphs (a)(1) and (a)(2) of this section based on appropriate modeling. DOT, in consultation with EPA, may also consider the current air quality circumstances of a given CO nonattainment or maintenance area in categorical hot-spot findings for applicable FHWA or FTA projects.*

values. FHWA has provided guidance for the application and documentation of a categorical hot-spot finding. This guidance is available at the EPA webpage provided above. These findings may be applied for all areas even if they are in attainment for CO.

2.1.3 PennDOT Project Scoping Thresholds

In addition to the exemptions and categorical hot-spot findings discussed above, PennDOT has developed screening thresholds to assist in scoping the appropriate level of CO air quality analysis for transportation improvement projects in Pennsylvania. The goal is to identify highway projects which, based on their type, configuration, projected traffic volume, congestion, and location are not considered of air quality concern. These projects (including exempt projects) are to be assessed qualitatively and do not require any detailed air quality analysis. Those projects that exceed defined thresholds are to be assessed quantitatively, either using an approved screening model or through detailed atmospheric dispersion modeling.

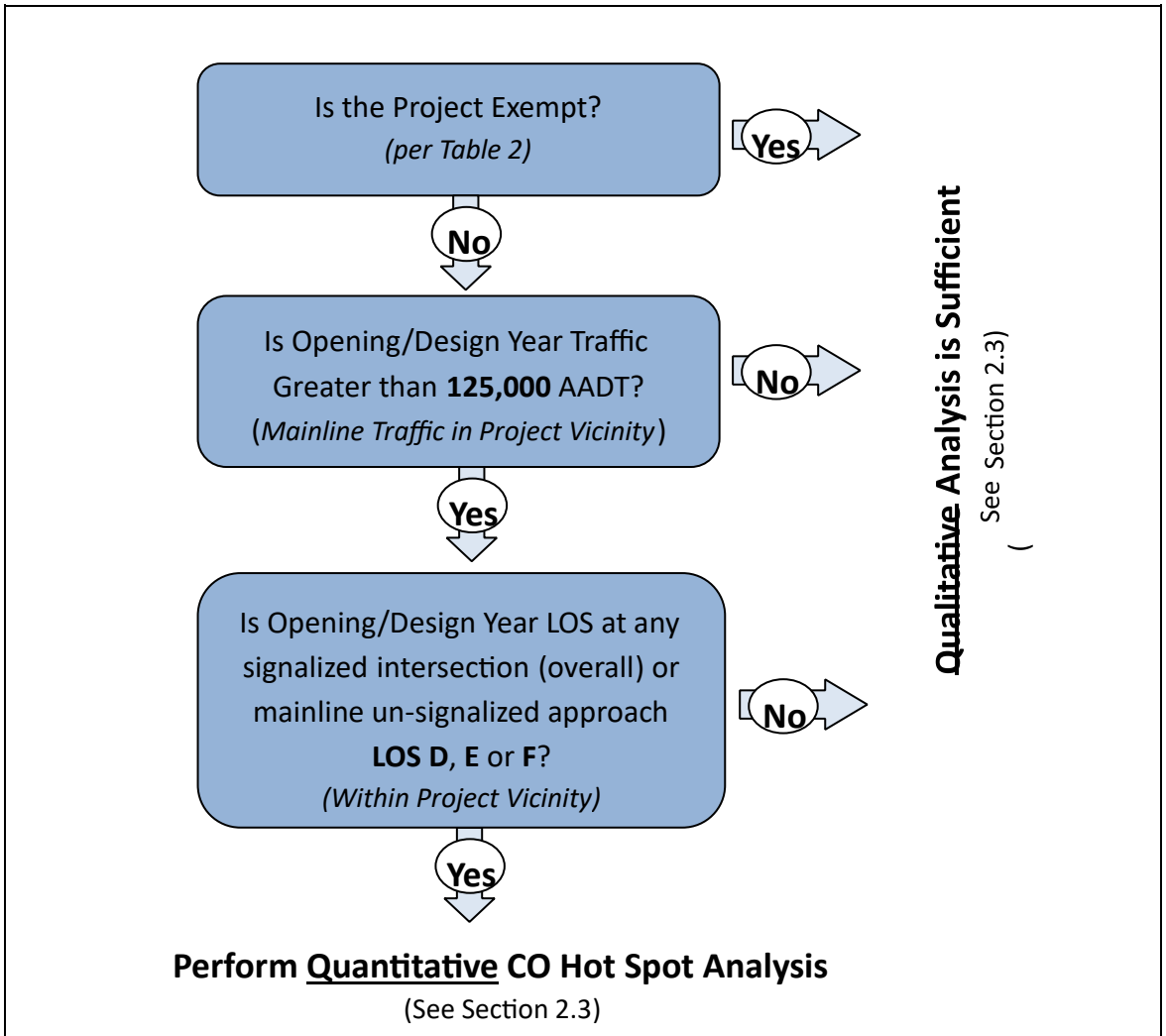
In an effort to streamline the NEPA process, PennDOT and FHWA have developed several thresholds that are used to limit the number of projects requiring a detailed CO quantitative air quality analysis. The scoping flow chart is displayed in **Figure 2**.

NOTE: On-line bridge replacement projects within the study area that do not add travel lanes or capacity are typically considered "exempt" from CO hot-spot analyses. Air quality assessments for these types of projects should follow the qualitative analysis procedures in **Section 2.2**.

2.2 CO Qualitative Analyses

A qualitative analysis should be performed for transportation improvement projects that are determined to be insignificant from an air quality perspective per the above sections. For projects that are exempt per the transportation conformity rule (**Table 2**), a simple statement of the exemption status should be included in the NEPA documentation. For non-exempt projects, a qualitative analysis may also be adequate if a project is not expected to adversely impact project-level air quality levels. This should be based on the traffic volume and level-of-service thresholds identified in **Figure 2**. For such projects, a qualitative analysis will consist of a project description, a general overview of the existing and future CO air quality, and a summary of the screening criteria. **Section 6** provides additional information on the reporting requirements for such projects.

Figure 2: Project-level CO Analysis Scoping Flow Chart



NOTE: Level of Service Determination – Review of the future Level-of-Service (LOS) should be considered in determining the likelihood for potential air quality impacts. The Highway Capacity Manual defines LOS as a measure employed to describe roadway operational conditions in terms of speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of LOS are defined for transportation facilities, designated as LOS A (best operating conditions through LOS F (worst operating conditions)

2.3 Technical Procedures for CO Quantitative Analyses

A quantitative analysis should be performed on any project that exceeds the thresholds identified in **Figure 2.** PennDOT EPDD should be contacted to determine the type and scope of the technical analysis. A quantitative analysis may consist of a screening analysis based on worst-case modeling assumptions or modeling that uses site-specific and area-specific data to predict more-realistic CO concentrations under actual operating conditions. A summary of the protocol for micro-scale modeling analyses is included below.

Detailed air quality modeling consists of running the EPA emission factor model in conjunction with a highway dispersion model. Interface software may also be applied at the discretion of the Department and may include FHWA, EPA and/or vendor or third-party software. This detailed modeling approach will account for all modeling parameters and provide the analyst with a more accurate representation of existing and future worst-case CO levels within the corridor. The following sections discuss many of the considerations necessary for detailed air quality modeling. The following EPA guidance for micro-scale CO modeling should also be consulted before initiating a CO micro-scale analysis:

- EPA-454/R-92-005, *Guidelines for Modeling Carbon Monoxide from Roadway Intersections*, November 1992.
- EPA-420-B-15-025, *Using MOVES2014 in Project-Level Carbon Monoxide Analysis*, March 2015.

The MOVES guidance supersedes the emission factor sections from the 1992 Guidelines to reflect the use of the MOVES emissions model for project-level CO analyses.

2.3.1 EPA/FHWA Approved Models

The micro-scale CO modeling process relies on EPA-approved air quality models to simulate pollutant emissions of highway sources and the dispersion of those pollutants to near-by receptors. Several approved tools are available for the analysis.

MOVES

MOVES is EPA's latest approved mobile source emission model and provides emission factors by vehicle type and speed needed to conduct a CO micro-scale analysis. MOVES replaces the previous MOBILE versions of the software. MOVES is based on analysis of millions of emission test results and considerable advances in the Agency's understanding of vehicle emissions. The software used for MOVES allows EPA to easily incorporate new information on an ongoing basis. Before conducting a CO modeling analysis, EPA's website (https://www.epa.gov/moves) should be consulted to identify the latest version of the Web link for latest version of software and its corresponding default database. Periodic EPA's MOVES model updates are expected to correct software bugs, revise emission standards, and to increase user flexibility and performance. The current version of the model, and associated guidance is available for download from EPA's web site.

As referenced above, EPA has provided additional guidance for the use of the MOVES software for CO micro-scale modeling. The guidance provides examples on the use of MOVES for screening (worst-case) and more site-specific analyses. This includes the types of inputs and data needed to support model runs.

EPA Dispersion Models

CAL3QHC was traditionally EPA's approved mobile source dispersion model, a derivative of the more generic CALINE3 model, and is used to predict CO (and other inert pollutants) concentrations at sensitive locations adjacent to roadways and roadway intersections. The CAL3QHC model is an effective tool for predicting emissions due to motor vehicles operating under free-flow conditions, as well as from idling vehicles under stop-and-go conditions (near signalized intersections). The model considers roadway geometries, receptor locations, meteorological conditions, and vehicular emission rates (provided by MOVES). Additionally, it incorporates intersection-specific parameters

and detailed signal information (e.g., signal EPA's dispersion models: timing and intersection lane assignments) to predict pollutant concentrations at near-by sensitive receptors. Modeling guidance for the use of CAL3QHC is available on-line and through the EPA. The current version of the CAL3QHC model remains available for download from EPA's web site (https://www.epa.gov/scram/air-quality-dispersion-modeling).

The American Meteorological Society/EPA Regulatory Model (AERMOD) is EPA's recommended near-field dispersion model for many regulatory applications. AERMOD includes options for modeling emissions from area, volume, and point sources and can therefore model the impacts of many different source types, including highway and transit projects.

Effective May 22, 2017, EPA promulgated a final rule that revises their *Guideline on Air Quality Models* (https://www.epa.gov/scram). Through this rulemaking, EPA is replacing the CALINE models (including the CAL3QHC/ CAL3QHCR models derived from it) with AERMOD as the preferred model for refined modeling for mobile source applications. The final rule starts a 3-year transition period ending on January 17, 2020, before AERMOD is required as the sole dispersion model for refined modeling. Any refined analyses for which the air quality modeling was begun before the end of this 3-year period with a CALINE-based model can be completed after the end of the transition period with that model. In addition, EPA modified section 4.2.3.1(b) of the *Guideline* to reference EPA's 1992 CO guidance that employs CAL3QHC for CO screening analyses. This technical guidance will remain in place as the recommended approach for CO screening until such time that the EPA develops a new CO screening approach based on AERMOD or another appropriate model and updates the *Guideline* to include the new CO screening approach.

2.3.2 Analysis Data Needs

In order for the air quality analyst to accurately predict CO concentrations for all project scenarios, an array of information is required. EPA guidance documents previously referenced provide additional detail on the data needed to support the MOVES and CAL3QHC/AERMOD models. Data needs include but are not limited to the following:

- **Detailed Traffic Data (HCS or SYNCHRO) Reports** – Detailed HCS or SYNCHRO reports provide the air quality analyst with total traffic volumes, turning movements, saturation flow rates, total signal length, control type, and green time. The air quality analyst will need to request the data for each scenario and analysis year.

- **Detailed Intersection Schematics** – The air quality analyst will need to request the existing and proposed intersection schematics. This will allow the analyst to accurately represent all free-flow and turning lane geometry for the dispersion model.

- **MOVES Inputs** – The air quality analyst will need to coordinate with the appropriate MPO or PennDOT to request the most recent MOVES inputs for a particular region. This information is crucial for accurately predicting CO emissions in those areas where detailed Inspection/Maintenance (I/M), anti-tampering programs, or other non-default inputs may be needed. **Figure 1** provides a map of Pennsylvania identifying the organization responsible for regional air quality conformity evaluations in each region/county. MOVES input data (used for regional air quality conformity evaluations) should be requested from the appropriate agency to assist in the development of project-specific MOVES input parameters. In situations where local/regional air quality control information is not available, worst-case input variables should be assumed to ensure worst-case CO predictions.

- **Temperature Data** – The analyst will need to coordinate with PADEP (or other applicable sources) for region-specific temperature data for use in MOVES modeling. In order to ensure worst-case predictions, all CO modeling in Pennsylvania should be performed to simulate January conditions, the time of year when CO emissions are generally greatest due to the incomplete combustion of fossil fuels in cold conditions. Therefore, the air quality analyst should request the minimum, maximum and average temperatures for the most-recently available January conditions.

2.3.3 Consideration of Areas Sensitive to Air Quality Impacts

Consideration of areas sensitive to air quality should be identified during the scoping phase of the project. As a general rule, the modeling analysis should focus on those areas where the general public has continuous access and where maximum project-related pollutant concentrations are likely to occur. For projects that include signalized intersections, the three (3) intersections with worst-case levels of service (typically LOS D or worse) should be selected for the analysis.

For projects that do not include signalized intersections, reasonable worst-case modeling locations should be identified to evaluate maximum potential CO levels based on the details of the proposed improvements, vehicle emission source strength factors, traffic data, land use, and relative proximity of highway right-of-way lines to roadways. Locations of special interest land uses such as public parks or recreation areas should also be identified and evaluated, if present.

2.3.4 Receptor Locations

The most important step for the air quality analyst is selecting reasonable locations for air quality receptors. Generally, these areas are places where the general public has continuous access and where maximum total project-related CO concentrations are likely to occur. Since the highest CO concentrations tend to occur near signalized intersections, sidewalks are often a good choice when determining reasonable receptor locations. In general, receptors should be placed at each approach on both sides of the road where queues develop (Refer to EPA-454/R-92-005 for additional guidance). These areas will likely receive the highest CO concentrations within a project study area. Receptors should be placed at 1.8 meters (5.9 feet) above the ground to represent typical breathing height of the general public.

The following are all examples of <u>reasonable</u> receptor sites:

- Sidewalks to which the general public has access on a more-or-less continuous basis.
- A vacant lot near an intersection, where the general public would have continuous access.
- Portions of a nearby parking lot to which pedestrians have continuous access.
- Property lines of residences, hospitals, rest homes, schools, playgrounds, and the entrances and ground-level air intakes to all other buildings.

The following are all <u>unreasonable</u> receptor site locations:

- Median strips of roadways.
- Locations within the right-of-way on limited access highways.
- Within intersections or on crosswalks at intersections.
- Tunnel approaches.
- Within tollbooths.
- Unoccupied land inaccessible to the general public.

2.3.5 Determination of Analysis Years

The air quality analyst should predict CO concentrations for existing, opening year (estimated time of completion (ETC)) and design year (typically ETC + 20 years) conditions for both the No-build and Build options, based on existing/anticipated peak-hour traffic volumes and speeds. Additionally, interim years may need to be considered if a spike in traffic volumes due to the completion of nearby or regional projects are likely to have a cumulative impact within the project area. By developing this comparison between No-build and Build conditions, conclusions can be developed on how the transportation improvement project will affect CO concentrations throughout the project corridor.

As a worst-case condition (from an emission standpoint), every attempt should be made to model opening year (ETC) conditions, since CO emission rates decrease with time. However, in situations where this traffic data is not available, the design year traffic volumes are recommended for evaluation with opening year vehicle emission levels to represent extreme worst-case conditions in the opening year of the project. If CO impacts are identified for opening year conditions under these modeling parameters, more refined traffic analysis may be necessary to more accurately model and predict true opening year conditions.

2.3.6 Determination of Background Concentrations

The project-level CO modeling analysis must consider not only pollutant concentrations associated with the proposed project, but also background CO concentrations that may be present in a given area. In order to determine background CO concentrations in a given project area, a number of different methods or assumptions can be used. For the purposes of this guidance, the following sections are recommended when determining background CO concentrations.

The PADEP – Bureau of Air Quality maintains a network of air quality monitoring stations (https://www.pa.gov/agencies/dep/programs-and-services/air/bureau-of-air-quality/pollutant-topics/pollutants-monitoring-sites.html) across the state. The goals of Pennsylvania's ambient air monitoring program are to evaluate compliance with federal and state air quality standards, provide real-time monitoring of air pollutant episodes, develop data for trend analysis, support the development and implementation of air quality regulations, and provide information to the public on daily air quality conditions.

PADEP monitors air quality in areas having high population density, high levels of expected contaminants, or a combination of both factors. There are currently a total of 20 CO monitoring stations located throughout the state.

Whenever possible and/or practical, the air quality analyst should reference the closest PADEP monitoring station to document the CO concentration during the last reporting year. In the event that the monitoring site is located more than 20 miles from the project site or does not adequately represent the project area, a default value should be assumed. Temperature data (for use in CO modeling) is also available from each of the PADEP monitoring stations or from a host of on-line sources in the event that no PADEP monitoring sites are in proximity to a given project area.

In the event that air quality monitoring data is not available or appropriate for the project corridor, a default background level should be assumed. In Pennsylvania, typically a one-hour background concentration for rural conditions should be assumed at 2.0 parts per million (ppm). An eight hour concentration is unlikely to be required for a rural area, as it is highly unlikely for a one-hour

concentration to exceed the NAAQS. See Section 2.3.9 for more information. For urban / suburban conditions, a typical one-hour background concentration of 3.0 ppm should be assumed, and a typical eight-hour background concentration of 1.5 ppm should be assumed.

These assumed background levels are intended to represent worst-case ambient conditions based on review of recent conditions and trends at current monitoring stations throughout the state. In all cases, either monitored or assumed background CO concentrations should be added to project specific CO predictions after the modeling is complete and worst-case project-level CO concentrations are predicted. This is true for the estimation of both one-hour and eight-hour CO levels.

***NOTE**:* Project-specific and background concentrations should be combined using the following formula:
- One-hour project-level + one-hour background concentration = total reported one-hour CO level (ppm)
- Eight-hour project-level* + eight-hour background concentration (ppm) = total reported CO level (ppm)

** see Section 2.3.7 (Averaging Periods) related to the estimation of eight-hour levels from one-hour levels*

2.3.7 NAAQS for CO and Required Averaging Periods

The NAAQS for CO are 35 parts per million (ppm) and 9 ppm for the second-highest one-hour and eight-hour periods, respectively. These are the primary standards adopted to protect against adverse health effects to the general public, including sensitive populations such as asthmatics, children, and the elderly.

Consistent with these EPA standards, total CO concentrations (i.e., project-level + background level) for project-level analyses should be projected to represent worst-case one-hour and eight-hour averaging periods. The air modeling emission/dispersion analysis should be conducted using a one-hour averaging period. Eight-hour concentrations should be derived by applying a persistence factor to the one-hour level to predict eight-hour levels.

The concept of a persistence factor represents a combination of the variability in both traffic and meteorological conditions, focusing on one-hour and eight-hour durations. FHWA guidance for the calculation of project-specific persistence factors is provided in EPA-454/R-92-005, *Guidelines for Modeling Carbon Monoxide from Roadway Intersections*, November 1992.

For the purposes of most project-level air quality modeling assessments, air quality impacts are not anticipated (i.e., project does not have the potential for causing a violation of the one-hour or eight-hour NAAQS for CO). EPA supports the concept of using a worst-case assumed persistence factor to simplify the conversion of one-hour concentrations to eight-hour concentrations. EPA recommends the use of a default factor of 0.7 to convert from peak one-hour concentrations to peak eight-hour concentrations. This factor is reasonably conservative based on review of state-wide CO monitoring data. Generally, this approach will be adequate to show compliance with the NAAQS for most CO modeling analyses.

If the conversion from one-hour to eight-hour concentrations using an assumed persistence factor (of 0.7) leads to total CO concentrations above the NAAQS for CO (i.e., has the potential for contributing to a violation of the NAAQS for CO), more refined (less conservative) techniques are available. These more refined techniques rely on the review of area-specific CO monitoring data, project-specific traffic data, or more refined modeling practices to avoid unrealistically high eight-

hour predictions (above the NAAQS). FHWA and EPA guidance documents can be referenced for information on these more refined techniques.

2.3.8 Micro-Scale Modeling Defaults

EPA-454/R-92-005, *Guidelines for Modeling Carbon Monoxide from Roadway Intersections*, November 1992 provides guidance for the appropriate meteorological conditions (and other model defaults) that should be specified for both emission estimates (MOVES) and dispersion modeling (CAL3QHC). At this time, modeling defaults for EPA's AERMOD dispersion model have not been defined. **Table 4** provides a general summary of the input parameters that should be used for CO modeling purposes in Pennsylvania.

Table 4: Modeling Defaults (when detailed information is not available)

Modeling Parameter	Default Value
Temperature	Min, Max, and/or Average Temp for January Conditions
Wind Speed	1.0 meter per second (m/s)
Wind Direction	varying wind direction 0 to 350 degrees at 10 degree increments
Atmospheric Stability Class	Urban - Stability Class D; Rural – Stability Class E
Mixing Height	1000 meters
Surface Roughness	See EPA Guidance
Saturation Flow Rate	1600 vph (when value is not available)
Clearance Time Lost	2 Seconds (average driver)
Arrival Rates	Average Progress
Receptor Heights	1.8 meters (5.9 ft.)
Settling and Deposition Velocity	0 for CO

2.3.9 Compliance with NAAQS for CO

At the completion of the micro-scale air quality (CO) modeling analysis, total CO concentrations (i.e., project-level + background level) for existing, opening (ETC), and design years, for each alternative evaluated (including No-build option) should be compared to the NAAQS for CO. The NAAQS for CO are 35 ppm and 9 ppm for the second-highest one-hour and eight-hour periods, respectively.

As discussed in Section 2.3.7 (NAAQS for CO and Required Averaging Periods), modeling should be performed to predict one-hour concentrations and a *persistence factor* should be applied to one-hour levels to predict eight-hour concentrations. If both the one-hour and eight-hour total CO concentrations are found to be below the corresponding NAAQS, no CO violations are anticipated. If so, the CO analysis should progress to the documentation phase. Consistent with FHWA and EPA guidance, if the modeled one-hour analysis predicts CO concentrations below the eight-hour standard (9 ppm), separate eight-hour estimates (using a persistence factor) are generally not necessary. In these instances, the CO analysis can progress to the documentation phase with no analysis necessary for eight-hour concentrations.

2.3.10 Model Refinement and Air Quality Avoidance / Relief Techniques

As a result of this worst-case scenario forecasting, mobile source air quality modeling typically over-predicts CO concentrations when compared to actual operating conditions. These

overpredictions do not pose a problem as long as predicted levels fall below the NAAQS. In this case, the modeling exercise is used to ensure a proposed project does not have the potential for causing a violation of the NAAQS for CO. If preliminary air quality screening analyses or a detailed microscale modeling analysis lead to CO concentrations above the NAAQS, refined modeling techniques are available to more accurately predict real-world conditions. Refined modeling techniques may include the use of local meteorological data or development of area/project specific (eight-hour) persistence factors.

If refined modeling techniques are necessary, consultation with PennDOT's EPDD is recommended. In the event that refined modeling still leads to CO concentrations above the NAAQS, air quality impact avoidance/relief measures may be necessary. Although relief strategies are somewhat limited, any activity which reduces congestion and/or increases facility speeds will typically improve local air quality. Some possible relief strategies include roadway/intersection design modifications, intersection operational changes (e.g. signal coordination, retiming, or rephasing), or other congestion management strategies. Such considerations should be coordinated with the project's highway and/or traffic engineering staff.

3.0 PARTICULATE MATTER (PM) PROJECT-LEVEL ANALYSES

PM is a term used to describe particles in the air including dust, dirt, soot, smoke, and liquid droplets. PM is of increased interest because diesel vehicles emit significant levels of the pollutant and diesel particulate has been identified as a probable carcinogen (cancer-causing substance) by the EPA.

$PM_{2.5}$ is used as a measure of fine particulate, in which the particles are 2.5 microns or less in size. Fine particles of this size are typically, but not exclusively, formed as a product of combustion or of secondary formation. Direct emissions from combustion are of primary concern for project-level analyses, but in some cases re-entrained road dust and emissions from long term construction activities may require analysis. Several $PM_{2.5}$ nonattainment areas have been established in the Commonwealth and therefore this is a pollutant of concern for project-level analyses and needs to be analyzed in a hot-spot analysis according to the conformity regulations for nonattainment or maintenance areas. The EPA Green Book can be consulted to identify that latest attainment status for each Pennsylvania County.

In April 2012, EPA published a Final Rule (40 Code of Federal Regulations [CFR] 93.116) that establishes transportation conformity criteria and procedures for determining which transportation projects must be analyzed for *local* air quality impacts in $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas. Beginning December 20, 2012, a quantitative PM hot-spot analysis using EPA's MOVES emission model is required for those projects that are identified as projects of local air quality concern. Quantitative PM hot-spot analyses are not required for other projects. A screening process, including interagency consultation, has been established to evaluate which projects require quantitative hot-spot analyses. The screening process includes several levels with multiple regional, state, and federal partners.

In November 2015, EPA released updated guidance for completing quantitative PM hot-spot analyses: *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (EPA-420-B-15-084). This guidance must be used by state and local agencies to conduct quantitative hot-spot analyses for new or expanded highway or transit projects with significant increases in diesel traffic in nonattainment or maintenance areas.

3.1 Screening Projects for PM Quantitative Analysis

Available EPA and FHWA rulemaking and guidance currently does not provide specific thresholds for determining which projects are of air quality concern (e.g. projects that require a qualitative or quantitative hot-spot analysis); however, examples are provided in the rule preamble and the federal guidance. To assist in the decision-making process, PennDOT (via interagency consultation with EPA, FHWA, FTA, PADEP, MPOs, and applicable transit agencies) established a screening procedure to determine projects of air quality concern. This section provides an overview of the PennDOT screening process.

Projects will be considered for hot-spot screening as the project is developed, following PennDOT's project development process. Projects already under development that do not have a conformity determination or for which a new conformity screening or determination is necessary per 40 CFR 93.104(d) will be identified as such as early as possible prior to the next anticipated FHWA or FTA action to adopt, accept, approve, or fund a non-exempt phase of a project.

An interagency consultation group (ICG) has been established to support decisions for determining projects of air quality concern. This group coincides with the Pennsylvania Air Quality Working Group that has been established to support regional conformity analyses. PennDOT's District Office will typically be the lead agency for highway-related projects. Other agencies may serve as the lead for transit projects. In either case, PennDOT's EPDD will typically initiate the consultation process and assure that all relevant

documents and information are supplied to consultation process participants in a timely manner and maintaining a written record of the consultation process.

The screening process has three distinct screening levels as illustrated in **Table 5**. A project does not have to go through each screening level. For example, if a project is determined to be *exempt* in Level 1 screening, then additional traffic data and interagency consultation review are not required; likewise, if the project can be screened using the Level 2 thresholds, then the ICG review is not needed.

Table 5: Summary of PM Project Screening Levels

Screening Level	Criteria Based On	Who Makes the Decision?	What Data Used?
LEVEL 1 Is the project exempt or does the project fall in an area that requires analysis?	Final Rule and EPA/FHWA guidance	PennDOT, District	Maps of nonattainment and maintenance areas and/or Exempt project table.
LEVEL 2 Is the project clearly not of air quality (AQ) concern?	Above plus assumptions	PennDOT, District	*Level 2 Flowchart (Figure 3)* Project traffic data, Base year traffic maps, and/or Intermodal facility information.
LEVEL 3 Does the project require more substantial review to determine if it is of AQ concern?	Above plus ICG review of project	ICG*	Project traffic data, Base-year traffic maps, and/or Intermodal facility information.

** ICG decisions are by consensus*

Hot-spot analyses will not be required for most projects in $PM_{2.5}$ or PM_{10} nonattainment and maintenance areas; because most projects are not of air quality concern and many of these can be clearly addressed without a review by multiple agencies. This screening process assists appropriate staff in making determinations for some projects without formal interagency review of the project data.

3.1.1 Level 1 Project Screening

The Level 1 screening process is used to initially determine whether a project is exempt from a $PM_{2.5}$ or PM_{10} hot-spot analysis or whether a hot-spot analysis is required. Projects that can be screened from conducting a hot-spot analysis include:

- Projects that are not located in a $PM_{2.5}$ or PM_{10} nonattainment or maintenance area (see EPA Green Book)
- Projects that do not involve a federal (FHWA/FTA) action to adopt, accept, approve, or fund a phase of the project do not require hot-spot analyses.
- Projects that are exempt from regional transportation conformity according to 40 CFR 93.126 or 93.128 (see **Table 2** and **Table 3**). A hot-spot analysis, however, may be required if the project affects an area designated in a $PM_{2.5}$ or PM_{10} SIP as a site of possible violation. However, there are currently no such areas. PADEP may need to be consulted to determine if future designations exist.

Note that project-specific transportation data (e.g. traffic volumes, truck percentages, level-of-service) do not need to be reviewed for Level 1 screening. PennDOT will initiate the Level 2 screening process if a project requires a hot-spot conformity determination (non-exempt per Level 1 screening).

3.1.2 Level 2 Project Screening

Projects that cannot be clearly defined as exempt under Level 1 are advanced to Level 2. The Level 2 screening process quickly identifies projects (which are not exempt and are located within a $PM_{2.5}$ or PM_{10} nonattainment or maintenance area) that clearly do not create new PM hot-spots or worsen existing air quality conditions. PennDOT will review project information, including traffic/truck volumes and LOS. If the project is identified as being "not of air quality concern," this determination is documented in the project record. If a determination cannot be made under the Level 2 screening, then PennDOT will initiate the Level 3 screening process that includes interagency review.

The ICG has agreed on criteria and assumptions to screen out projects that clearly do not contribute or worsen air quality conditions within the project area. This required the development of and consensus on several key assumptions, including the following:

- Total traffic and diesel truck volume totals or increases that clearly do not cause a potential $PM_{2.5}$ or PM_{10} hot-spot concern.
- Vehicle classes should be considered to represent diesel trucks.

The assumptions for the Level 2 screening process are illustrated in **Figure 3**. Supporting information is provided in the associated footnotes. The ICG may reconsider these assumptions and decisions, particularly upon the receipt of future federal guidance or additional information.

The ICG has determined that FHWA Class 4-13 trucks are heavy-duty trucks. In reality, diesel trucks are a subset of the total truck numbers. Total truck volumes are used since these are most likely the values provided by traffic studies and serve as a more conservative estimate of potential PM emissions. The term *project vicinity* includes traffic on the project roadway(s) but may also include traffic at or on cross roads for intersections or interchanges, parallel collector-distributor roadways, other parallel roads impacted by the project, nearby intermodal/transit facilities, and other locations of diesel vehicle idling. Similar approaches would be used for rail and transit projects.

Projects that are considered not of air quality concern per the Level 2 screening criteria should include reasons for that conclusion within the hot-spot conformity determination section of the environmental report.

Figure 3: Level 2 Project PM Screening Process

<table>
<tr><th>Project Type</th><th colspan="3">Level 2 Screening Evaluation Criteria</th></tr>
<tr><td rowspan="4">Highway Capacity <u>Expansion</u></td><td colspan="3">Is the design year <u>total</u> Build condition traffic volume ≤125,000 annual average daily traffic (AADT) and <u>truck</u> volume ≤10,000 heavy trucks per day in the project vicinity [1] ?</td></tr>
<tr><td>YES</td><td colspan="2">NO</td></tr>
<tr><td rowspan="2">Not a Project of AQ Concern</td><td colspan="2">Does the project cause a ≤6,250 and ≤500 increase in total and truck volume respectively between Build and No Build conditions [2] ?</td></tr>
<tr><td>YES
Not a Project of AQ Concern</td><td>NO
Level 3 ICG Screening Required</td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td rowspan="4">Intersection (Channelization, Circles, Roundabouts, Signalization) or Interchange Reconfiguration</td><td colspan="3">Does the above criteria for the “Highway Capacity Expansion” project type identify this project as “Not a Project of AQ Concern” ?</td></tr>
<tr><td>YES</td><td colspan="2">NO</td></tr>
<tr><td colspan="2">Is the project expected to improve (or not further degrade) LOS and delay for the roadway with the highest number of diesel vehicles in the project vicinity [3] ?</td><td rowspan="3">Level 3 ICG Screening Required</td></tr>
<tr><td>YES
Not a Project of AQ Concern</td><td>NO
Level 3 ICG Screening Required</td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td rowspan="4"><u>New</u> Highway, Expressway, or Interchange Construction</td><td colspan="3">Is the design year <u>total</u> traffic volume ≤125,000 AADT <u>and</u> <u>truck</u> volume ≤10,000 trucks per day in the project vicinity [4] ?</td></tr>
<tr><td>YES</td><td colspan="2">NO</td></tr>
<tr><td colspan="2">Does the project include new ramps or other improvements to connect a highway to a major freight, bus, or intermodal terminal ?</td><td rowspan="3">Level 3 ICG Screening Required</td></tr>
<tr><td>YES
Level 3 ICG Screening Required</td><td>NO
Not a Project of AQ Concern</td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td rowspan="6"><u>Expanded</u> Intermodal or Transit Facility for Rail, Bus, or Truck</td><td colspan="3">Is the existing facility <u>not</u> regionally significant under 40CFR 93.101[5] <u>or</u> does the expanded facility have ≤10 buses/trucks in peak hour (of that facility) [6] ?</td></tr>
<tr><td>YES</td><td colspan="2">NO</td></tr>
<tr><td rowspan="4">Not a Project of AQ Concern</td><td colspan="2">Will the facility involve a ≥25% increase in peak diesel bus/truck arrivals between Build and No Build conditions [7] ?</td></tr>
<tr><td>YES</td><td>NO</td></tr>
<tr><td>Will the facility expansion include >80% non-diesel vehicles (CNG, Hybrid, etc.) [8] ?</td><td rowspan="2">Not a Project of AQ Concern</td></tr>
<tr><td>YES
Not a Project of AQ Concern</td><td>NO
Level 3 ICG Screening Required</td></tr>
<tr><td></td><td colspan="3"></td></tr>
</table>

New Intermodal or Transit Facility For Rail, Bus, or Truck	Is the facility considered to be a "regionally significant project" under 40 CFR 93.101[5] ?	
	YES	**NO**
	Level 3 ICG Screening Required	**Not a Project of AQ Concern**
Other Project Types	**Level 3 ICG Screening Required**	

Figure 3 Footnotes:

(1) In Appendix B of November 2015 EPA Guidance (EPA-420-B-15-084), examples are provided that indicate the most likely projects that would be covered by 40 CFR 93.123(b)(1) and require a $PM_{2.5}$ or PM_{10} hot-spot analysis. This includes a project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 AADT and 8% more of such AADT is diesel truck traffic.

(2) If a project causes total traffic (for the year of peak emissions) to be greater than the 125,000 AADT and 10,000 heavy-duty truck thresholds, then the project's impact (Build vs. No-build, year of peak emissions, etc.) must be evaluated and compared to this threshold. The ICG has determined that a change of 5% of total traffic or truck volume initiates the need for formal ICG review of the project data. This percentage incorporates some potential error inherent in forecasts. The percentage has been applied to the 125,000 AADT and 10,000 truck thresholds to provide the criteria used for this screening (6,250 AADT and 500 trucks).

(3) The ICG will review project data for worsening of LOS or delay for the roadway with the highest number of diesel vehicles. It may be expected that an intersection project may create a worsened condition for some intersection approaches (potentially local or small volume roadways) and improve the LOS at others.

(4) A new roadway that will carry above the traffic volume thresholds discussed in footnote 1 is assumed to require a Level 3 screening by the ICG to determine if the project is of air quality concern.

(5) 40 CFR 93.101 defines a *regionally significant project* as "a transportation project (other than an exempt project) that is on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network, including, at a minimum, all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel."

(6) Appendix B of November 2015 EPA Guidance (EPA-420-B-15-084) indicates that an example of a project that is not of air quality concern is "a 50% increase in daily arrivals at a small terminal (e.g., a facility with 10 buses in the peak hour)." The ICG is using this example of a small terminal as a threshold for project screening.

(7) Appendix B of November 2015 EPA Guidance (EPA-420-B-15-084) indicates that an example of a project that is of air quality concern is "an existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50% or more, as measured by arrivals." The ICG has decided to use a more conservative estimate of 25% for Level 2 project screening.

(8) Appendix B of November 2015 EPA Guidance (EPA-420-15-084) indicates that an example of a project that is not of air quality concern is "a new or expanded bus terminal that is serviced by non-diesel vehicles (e.g., compressed natural gas) or hybrid electric vehicles." The ICG has concluded that if 80% of fleet addition or additional activity is related to non-diesel vehicles, then the project may be determined as not of air quality concern.

3.1.3 Level 3 Project Screening

Projects that cannot be screened (e.g. determined to be a project not of air quality concern) using the Level 2 thresholds are to be submitted to the ICG to make the decision on whether the project

is of air quality concern, requiring a quantitative hot-spot analysis. Level 3 screening may use the same or more detailed information as the Level 2 screening but is performed and decided by the ICG rather than a single person or agency.

PennDOT EPDD will be responsible for coordination with the ICG and will distribute information and relevant data. The interagency review will be conducted via electronic mail, paper, telephone, and/or meetings. Data shared with the ICG will include information compiled for the Level 2 screening, additional detailed traffic and other project descriptions. **Appendix 1** provides a sample template for providing information to the ICG. Participants will be required to provide responses within 2 weeks from the date the consultation is initiated. In the event of unexpected circumstances, the schedule may be amended as necessary to provide supplemental information or to allow additional time for review. The absence of a response from a participant will indicate that the agency he/she represents considers the project to be not of air quality concern. A consensus approach among participating ICG members will be used in making the determination as to a project being of air quality concern. The PennDOT EPDD will be responsible for producing a summary of ICG decisions that should be included in the project-level hot-spot conformity determination, including a list of the consultation partners and the date of decision. If a project is determined to be of air quality concern per the Level 3 screening, then a quantitative hot-spot analysis is required as discussed in the following sections.

3.2 Technical Procedures for Conducting PM Quantitative Analyses

In November, 2015, EPA released *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (EPA-420-B-15-084). This document provides guidance for quantifying the local air quality impacts of certain transportation project for the $PM_{2.5}$ and PM_{10} NAAQS. This guidance must be used by state and local agencies to conduct quantitative hot-spot analyses for new or expanded highway or transit projects with significant increases in diesel traffic in nonattainment or maintenance areas. The steps required to complete a quantitative PM hotspot analysis are summarized in **Figure 4.** A hot-spot analysis compares the air quality concentrations with the proposed project (the build scenario) to the air quality concentrations without the project (the No-build scenario). These air quality concentrations are determined by calculating a design value which is a statistic that describes a future air quality concentration in the project area that can be compared to a particular NAAQS. It is always necessary to complete emissions and air quality modeling on the Build scenario and compare the resulting design values to the relevant PM NAAQS.

Web link to EPA guidance for completing a PM quantitative hot-spot analysis: https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses#pmguidance

Guidance does not change or revise any recommendations provided in EPA guidance for conducting a PM quantitative hot-spot analysis. All analyses should consider the following regulatory requirements for PM hot-spot analyses from Section 93.123(c) of the Conformity Rule:

- Estimate the total emissions burden of direct PM emissions: project and background;
- Include the entire transportation project, after identifying the major design features that will significantly impact local concentrations;
- Use assumptions consistent with those used in regional emissions analyses for inputs required in both analyses (e.g., temperature, humidity);
- Assume mitigation or control measures only where written commitments have been obtained; and

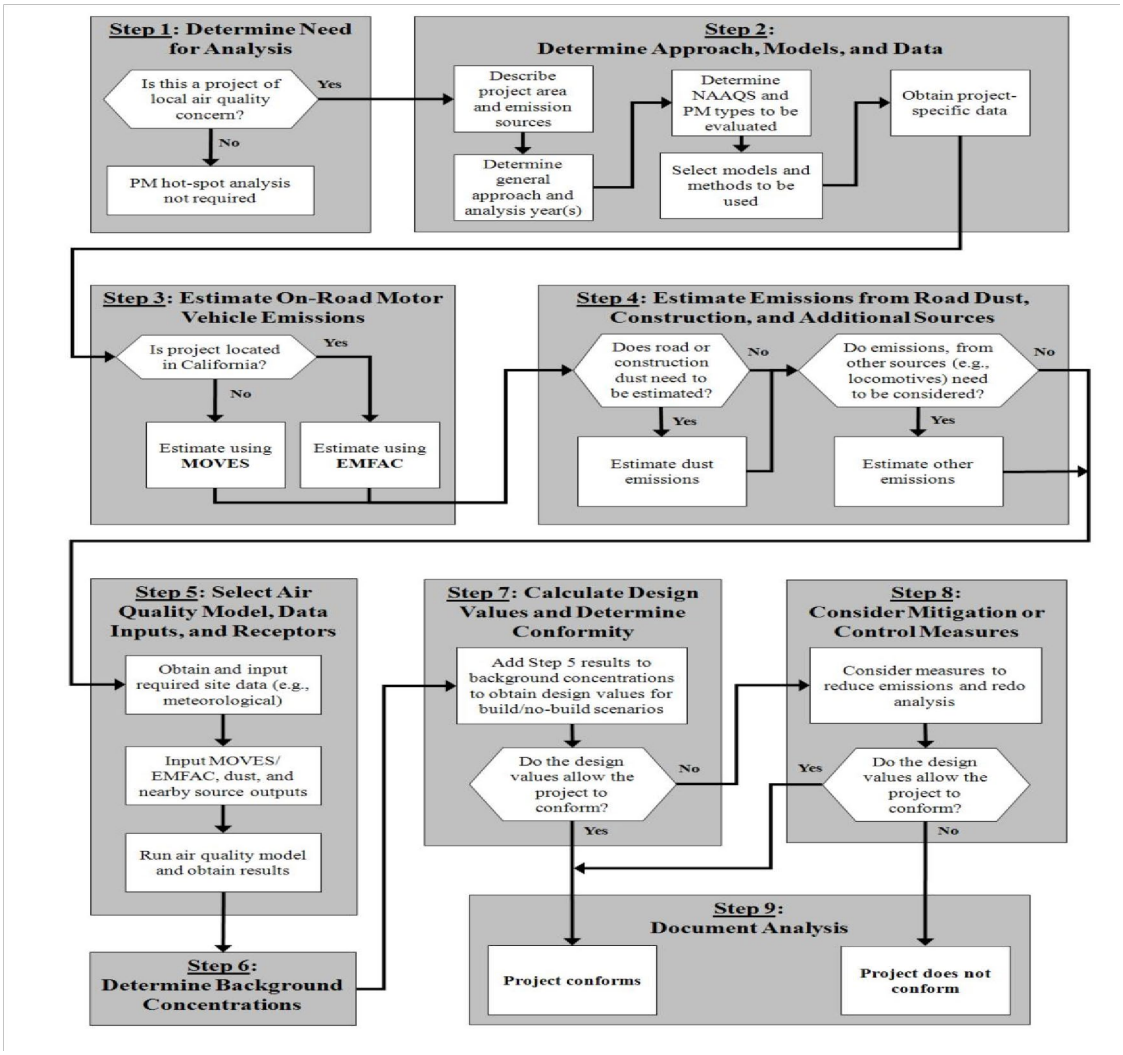
- Consider emissions increases from construction-related activities only if they occur during the construction phase and last more than five years at any individual site. PM hot-spot analyses are not required to consider temporary increases

The interagency consultation process is an important component in completing project-level conformity determinations and hot-spot analyses. Per (40 CFR 93.105(c)(1)(i)), interagency consultation must be used to develop a process to evaluate and choose models and associated methods and assumptions. EPA guidance states that this would include:

- The geographic area covered by the analysis;
- The emissions models used in the analysis (e.g. choice of dispersion model, MOVES version);
- Whether and how to estimate road and construction dust emissions;
- The nearby sources considered, background data used, and air quality model chosen, including the background monitors/concentrations selected and any interpolation methods used; and The appropriateness of receptors to be compared to the $PM_{2.5}$ NAAQS.

Agencies / consultants should contact PennDOT EPDS to initiate interagency consultation on assumptions and tools.

Figure 4: Completing a PM Hot-Spot Analysis (Exhibit 3-1 from National EPA guidance)



4.0 MOBILE SOURCE AIR TOXICS (MSATs) PROJECT-LEVEL ANALYSES

Controlling air toxic emissions became a national priority with the passage of the CAAA of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list and identified nine compounds with significant contributions from mobile sources. These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter are considered priority MSATs.

While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules. Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

MSATs analyses are not currently required per conformity and NEPA regulations. Nonetheless, air toxics concerns continue to be raised on highway projects during the NEPA process. The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this emerging field.

FHWA has developed interim guidance for the analysis of MSATs within the NEPA process for highways. The guidance was originally developed in February 2006 and updated in the October 18, 2016 memorandum, *Updated Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents.* This interim guidance replaces the previous Interim Guidance version issued on December 6, 2012. The October 2016 update was prompted by recent changes in emissions model required for conducting emissions analysis. Based on FHWA's analysis using the updated MOVES2014a, diesel particulate matter (diesel PM) remains the dominant MSAT of concern for highway projects.

Web link to FHWA's updated interim guidance for the analysis of MSATs (October 2016): http://www.fhwa.dot.gov/environment/

4.1 MSATs Analysis Levels

FHWA has developed a tiered approach for analyzing MSATs in NEPA documents. Depending on specific project circumstances, the FHWA has identified three levels of analysis:

1. No analysis for projects with no potential for meaningful MSAT effects;
2. Qualitative analysis for projects with low potential MSAT effects; or
3. Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

4.1.1 Projects with No Meaningful Potential MSATs Effects

The types of projects included in this category are:

- Projects qualifying as a categorical exclusion under 23 CFR 771.117(c);
- Projects exempt under the Clean Air Act conformity rule under 40 CFR 93.126; or

Other projects with no meaningful impacts on traffic volumes or vehicle mix.

For projects that are categorically excluded under 23 CFR 771.117(c), or are exempt from conformity requirements under the Clean Air Act pursuant to 40 CFR 93.126 (see **Table 2**), no analysis or discussion of MSATs is necessary. Documentation sufficient to demonstrate that the project qualifies as a categorical exclusion and/or exempt project will suffice. For other projects with no or negligible traffic impacts, regardless of the class of NEPA environmental document, no MSATs analysis is required. However, the project record should document the basis for the determination of "no meaningful potential impacts" with a brief description of the factors considered.

4.1.2 Projects with Low Potential MSATs Effects

The types of projects included in this category are those that serve to improve operations of highway, transit or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions. This category covers a broad range of projects, including most highway projects. Examples of projects covered in this section are minor widening projects; new interchanges, such as those that replace a signalized intersection on a surface street; or projects

where design year traffic is projected to be less than 140,000 to 150,000 annual average daily traffic (AADT).

For these projects, a qualitative assessment of emissions projections should be conducted. This qualitative assessment would compare, in narrative form, the expected effect of the project on traffic volumes, vehicle mix, or routing of traffic and the associated changes in MSAT for the project alternatives (including No-build), based on vehicle miles traveled (VMT), vehicle mix, and speed. It would also discuss national trend data projecting substantial overall reductions in emissions due to stricter engine and fuel regulations issued by EPA. Because the emission effects of these projects are low, it is expected there would be no appreciable difference in overall MSAT emissions among the various alternatives. In addition, quantitative analysis of these types of projects will not yield credible results that are useful to project-level decision-making due to the limited capabilities of the transportation and emissions forecasting tools.

4.1.3 Projects with Higher Potential MSATs Effects

This category includes projects that have the potential for meaningful differences in MSATs emissions among project alternatives. To fall into this category, a project must:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location; or
- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 or greater by the design year.

Also, these projects should:

- Be located in proximity to populated areas.

Although not required, other projects with high potential for litigation on air toxics issues or potential large increases to MSATs emissions may also benefit from a more rigorous quantitative analysis to enhance their defensibility in court.

Projects falling within this category should be more rigorously assessed for impacts. This approach would include a quantitative analysis to forecast local-specific emission trends of the priority MSATs for each alternative, to use as a basis of comparison. This analysis also may address the potential for cumulative impacts, where appropriate, based on local conditions. A defined quantitative analysis approach is not currently provided in EPA or FHWA guidance and may vary based on project details and location. As a result, interagency consultation will be required to identify the methods, assumptions and tools to be used for a quantitative analysis. PennDOT EPDS should be contacted if a MSATS quantitative analysis is potentially required. PennDOT will then initiate an interagency conference call to discuss the following key topics:

- Whether an analysis is required;
- Air quality methods and tools;
- Analysis years;
- Affected transportation network study area;
- Traffic volume projections;
- Available monitoring data; and
- Other pertinent MSAT or project-related information.

If the analysis for a project in this category indicates meaningful differences in levels of MSAT emissions, mitigation options should be identified and considered. Appendix E of FHWA's guidance provides information on lessening the effects of MSATs for projects with substantial construction-related emissions that are likely to occur over an extended building period, and for post-construction scenarios where the NEPA analysis indicates potentially meaningful MSAT levels.

Web link to FHWA's guidance on mitigation strategies (Appendix E): Appendix E - MSAT Mitigation Strategies - MSAT - Policy And Guidance - Air Toxics - Air Quality - Environment - FHWA

5.0 REGIONAL CONFORMITY DOCUMENTATION

A project-level air quality analysis must verify and document that all non-exempt, regionally significant projects being evaluated on a project-level are part of a conforming TIP and/or Long Range Transportation Plan (LRTP) that has been approved by both the regional planning organization and the USDOT.

Transportation projects must be analyzed on a regional level, when located in areas designated by the EPA as nonattainment or maintenance. Nonattainment areas are those that do not meet the NAAQS. Once a region is classified as nonattainment for an air pollutant, the state must develop a plan to bring the region back to attainment status, called a SIP. SIPs are agreements between the EPA and PaDEP. Maintenance areas are those that once violated the NAAQS and were classified as nonattainment but have since met NAAQS and the goals outlined in their SIP. Maintenance areas remain subject to certain emissions control measures and the conformity determination requirements and remain under air quality monitoring. Under limited circumstances (i.e. a limited maintenance plan) the requirement for a conformity analysis may be waived. EPA periodically reviews and may revise the NAAQS as it learns more about the individual pollutants and their level of impact on human health and the environment. The most recent NAAQS are displayed in Table 1. In addition, other transportation-related pollutants of concern, which are not criteria pollutants, include Mobile Source Air Toxics (MSATs). Air toxics, often called hazardous air pollutants, are pollutants known to cause cancer, other serious health effects, or adverse environmental effects. Air toxics can be from a variety of sources including automobiles. In addition to the NAAQS pollutants, EPA regulates MSATs. Nine of the MSATs, 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter are considered priority MSATs. EPA has yet to establish regulatory concentration targets for these nine MSATs. Greenhouse gases (GHG) are a group of compounds that are able to trap heat in the atmosphere, keeping the Earth's surface warmer than it would be if they were not present. Sources for GHG emissions, both direct and indirect, are typically evaluated globally or per broad scale sector (e.g., transportation, industrial, etc.) and not assessed at the project level. To date, no national standards have been established regarding GHGs, nor has the EPA established criteria or thresholds for ambient GHG emissions. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their impacts on climate, including reports from the Intergovernmental Panel on Climate Change (IPCC), the National Academy of Sciences, EPA, and other federal agencies.

Table 1 The EPA Green Book provides the latest air quality attainment status by pollutant for all areas of the country. Pennsylvania currently has multiple nonattainment and maintenance areas, including those for ozone and $PM_{2.5}$.

Web link to Pennsylvania nonattainment and maintenance areas in EPA's Greenbook: https://www.epa.gov/green-book

The regional air quality conformity analysis is ultimately a way to ensure that federal funding and approval are only given to those transportation activities (in nonattainment and maintenance areas) that are consistent with the provisions of the SIP for each pollutant (and any appropriate precursors) in a region. Conformity analyses forecast whether emissions associated with transportation plans and programs are within regional emission budgets identified in SIPs. In the absence of a motor vehicle budget ruled adequate by EPA or an EPA-approved SIP, the conformity regulations at 40 CFR Part 51 provide for interim analyses methods and criteria.

Figure 1 summarizes the agencies responsible for performing and documenting the conformity determinations in their respective nonattainment and maintenance areas. The larger urban MPOs are responsible for performing conformity analyses for their respective area. PennDOT is responsible for conformity for smaller urban MPOs and RPOs in the respective nonattainment and maintenance regions. During the regional conformity analysis, projects are screened and reviewed by the Pennsylvania Air Quality Working Group using established guidelines to determine the project status under exemption and regional significance classifications. Projects that are determined to be non-exempt and regionally significant must be included in the emissions analysis that constitutes the regional transportation and emissions modeling conducted for the region. FHWA and/or FTA, with EPA and PaDEP consultation, must approve all region-specific conformity determinations performed by local planning organizations or PennDOT.

5.1 EPA Classification of Attainment Status

Based on a proposed transportation project's location, a project-level analyst must identify the latest EPA attainment status for the area or region in which the project is located. If the county or a portion of the county is designated as attainment for all pollutants of concern (and not in maintenance status), the NEPA document should state the area is in attainment for transportation-related pollutants and indicate that a regional and project-level conformity analysis does not apply. If a project is located in a nonattainment or maintenance area and is considered non-exempt and regionally significant (see **Section 1.5** of Handbook), the project must be included in a conforming TIP. This finding, and relevant approval dates, should be included in the NEPA document.

5.2 Information for Inclusion in NEPA Documents

It is important to ensure that the project description (size and scope of the project) in a NEPA document is consistent with the project description in the TIP to ensure that an accurate representation of the project was included in the regional conformity determination. In the event that the project description (size and scope of project) changed as compared to the project description in the TIP evaluation, it is recommended that PennDOT's EPDS be notified as soon as possible to ensure the current project specifics can be included and reevaluated in the conformity determination, if needed.

6.0 REPORTING REQUIREMENTS FOR PROJECT-LEVEL AIR QUALITY

The following sections present the relevant discussions that should be included in the NEPA document where applicable for project-level CO, PM, and MSATs as associated with transportation improvement projects. Specific documentation requirements to address regional conformity are also addressed within this section. Sample documentation is provided below on a per-pollutant basis.

6.1 NEPA Documentation of CO Air Quality Analyses

The following sections present the relevant discussions that should be included in the NEPA document as related to CO air quality analyses. Documentation of CO analyses may be combined with other applicable analyses ($PM_{2.5}$, MSATs, and regional conformity).

6.1.1 Exempt and Screened Projects

As outlined in **Section 2.2**, projects that do not meet established thresholds are screened out of the process and a quantitative analysis is not required. These projects either fall under the exempt criteria found in **Table 2** (consistent with 40 CFR 93.126), or do not meet the LOS and/or the AADT cutoff specified in **Figure 2**. These types of projects have minimal potential to impact air quality and therefore no air quality is warranted. Documentation for such projects should include the following statements:

Projects Exempt per 40 CFR 93.126

"The subject project has been identified as being exempt from air quality analysis in accordance with 40 CFR 93.126. It can therefore be concluded that the project will have no significant adverse impact on air quality."

Project Screened through AADT criteria

"The subject project does not include or directly affect any roadways for which the 20-year forecasted daily volume will exceed the established threshold level of 125,000 vehicles per day. It can therefore be concluded that the project will have no significant adverse impact on air quality as a result of CO emissions".

Projects Screened through AADT and LOS Criteria

"Despite projected traffic volumes above the AADT threshold, the subject project is forecasted to experience minimal traffic congestion (LOS C or better) at all intersections within or directly affected by this project. It can therefore be concluded that the project will have no significant adverse impact on air quality as a result of CO emissions".

To support a qualitative analysis, non-exempt projects that have been screened from doing a quantitative CO air quality analysis may include additional documentation describing the project's impact on traffic, existing and future CO air quality within the region, and other relevant information as determined on a project by project basis.

6.1.2 Projects with Quantitative CO Analyses

For all projects in which an air quality analysis has been conducted, documentation in the NEPA document should be provided as outlined in this section of the guidance. When a quantitative CO assessment is performed, the NEPA document should summarize the results and methodology of the study with supporting data supplied in a detailed project-level air quality technical report (see **Section 6.5** for report content and requirements). A tabular summary of results should be provided

in the NEPA document for each analysis year and alternative under consideration (including the No-build option). For those projects that satisfy the NAAQS, the following statement should conclude the NEPA write-up;

"A project-level air quality analysis for CO has been conducted for the subject project and no receptor sites are forecast to experience concentrations in excess of the current one-hour or eighthour NAAQS. It can therefore be concluded that the project will have no significant adverse impact on air quality as a result of CO emissions".

6.2 NEPA Documentation of PM Air Quality Analyses

The following sections present the relevant discussions that should be included in the NEPA document where applicable for PM-related air quality analyses and screening associated with transportation improvement projects.

6.2.1 Screened/Exempt Projects

The information below includes sample text for conditions where a $PM_{2.5}$ or PM_{10} hot-spot quantitative analysis is <u>not</u> required:

<u>Projects in a $PM_{2.5}$ / PM_{10} Attainment Area</u>

For projects located in attainment areas (not in maintenance status), a conformity determination and a $PM_{2.5}$ and/or PM_{10} hot-spot quantitative analysis is not required. Document the county, area, or partial county nonattainment/maintenance designation and include the following statement in the environmental report:

"*The proposed project is located in an attainment area for the ____ (insert relevant pollutant, $PM_{2.5}$, PM_{10}, or both) standard(s). The project does not require a project-level conformity determination. According to the $PM_{2.5}$ and PM_{10} hot-spot analysis requirements established in the March 10, 2006, final transportation conformity rule (71 FR 12468), no further project-level air quality analysis for this/these pollutant(s) is required*."

<u>Project is Exempt from Hot-Spot Requirements</u>

For projects located in nonattainment or maintenance $PM_{2.5}$ and/or PM_{10} areas that are considered exempt according to the latest version of Table 2.1 of 40 CFR Part 93.126 and 93.128, a conformity determination or a quantitative $PM_{2.5}$ and/or PM_{10} analysis is not required. Document the county, area, or partial county nonattainment/maintenance designation and include the following statement in the environmental report:

"*The proposed project is located in a county that has been designated as being in nonattainment or maintenance (SPECIFY) for $PM_{2.5}$ and/or PM_{10}. According to the latest version of Table 2.1 of 40 CFR Part 93.126 and 93.128, the project is considered exempt from a quantitative $PM_{2.5}$ and/or PM_{10} analysis (LIST THE EXEMPTION FROM THE TABLE). No further project-level conformity determination or air quality analysis for this/these pollutant(s) is therefore required*."

<u>Non-Exempt Project that is Not a "Project of Air Quality Concern"</u>

(Not applicable to PM_{10} nonattainment/maintenance areas with an approved Conformity SIP. Liberty-Clairton is the only current Pennsylvania area and did <u>not</u> have a Conformity SIP prior to April 5, 2006. A PM_{10} Maintenance SIP does exist.)

For projects located in nonattainment or maintenance $PM_{2.5}$ and/or PM_{10} areas that are not considered exempt according to 40 CFR Part 93.126 and 93.128, a determination must be made if the project is considered to be of "air quality concern" under 40 CFR 93.123(b)(1)(i-v) and as further described in the March 29, 2006 EPA/FHWA guidance, "Transportation Conformity Guidance for Qualitative Hot-Spot Analysis in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas."

Document the reason why the project was not considered to be of air quality concern using **Figure 3** or additional information or conclusions based on the Level 3 ICG review of project data. A documented account of the ICG finding should be included in the NEPA documentation. This would include a listing of the ICG consultation partners, conclusions for the project, and a statement indicating a consensus decision and a date of approval. Additional data including a description of the data and memos provided for ICG review can be provided in technical support files.

The documentation may also include the following statements in conclusion:

- If Project Screened Using Level 2 Thresholds from **Figure 3** of Publication 321

"*The proposed project is located in a county that has been designated as being in nonattainment or maintenance (SPECIFY) for $PM_{2.5}$ and/or PM_{10}. The project is not exempt, however, it is not considered to be of air quality concern according to the thresholds provided in PennDOT Publication 321. These thresholds were agreed upon by an interagency consultation group considering 40 CFR 93.123(b)(1)(i-v) and Appendix B of the November 2015 EPA Guidance (EPA420-B-15-084) entitled "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas.".*

- If Project Screened Using Level 3 ICG Review

"*The proposed project is located in a county that has been designated as being in nonattainment or maintenance (SPECIFY) for $PM_{2.5}$ and/or PM_{10}. The project is not exempt, however, it is not considered to be of air quality concern based on an interagency review of project data and information according to 40 CFR 93.123(b)(1)(i-v) and Appendix B of the November 15 EPA Guidance (EPA-420-B-15-084) entitled "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas."* (PROVIDE ICG CONSULTATION PARTNERS AND DECISION DATE)

6.2.2 Projects with Quantitative PM Hot-Spot Analyses

When a quantitative PM hot-spot analysis is performed, the NEPA document should summarize the results and methodology of the study with supporting data supplied in a detailed project-level air quality technical report (see **Section 6.5** for report content and requirements). The air quality analysis results and all relevant information should be summarized in the body of the NEPA document including a tabular summary of results for each analysis year and alternative under consideration (including the No-build option). The technical report should describe the sources of data used in preparing emissions and air quality modeling inputs. This documentation should also describe any critical assumptions that have the potential to affect predicted concentrations. Documentation of PM hot-spot analyses would be included in the project-level conformity determination.

6.3 NEPA Documentation of MSATs Air Quality Analyses

The following sections present the relevant discussions that should be included in the NEPA document where applicable for MSAT concerns associated with transportation improvement projects.

6.3.1 Projects with No Meaningful Potential MSATs Effects

Projects with little or no meaningful potential MSATs effects should be documented according to Appendix A of FHWA's guidance memo. The prototype language for such projects is provided below:

The purpose of this project is to (insert major deficiency that the project is meant to address) *by constructing* (insert major elements of the project). *This project has been determined to generate minimal air quality impacts for Clean Air Act criteria pollutants and has not been linked with any special mobile source air toxic (MSAT) concerns. As such, this project will not result in changes in traffic volumes, vehicle mix, basic project location, or any other factor that would cause a meaningful increase in MSAT impacts of the project from that of the no-build alternative.*

Moreover, EPA regulations for vehicle engines and fuels will cause overall MSAT emissions to decline significantly over the next several decades. Based on regulations now in effect, an analysis of national trends with EPA's MOVES2014 model forecasts a combined reduction of over 90 percent in the total annual emissions rate for the priority MSAT from 2010 to 2050 while vehicle-miles of travel are projected to increase by over 45 percent (Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, Federal Highway Administration, October 12, 2016). This will both reduce the background level of MSAT as well as the possibility of even minor MSAT emissions from this project.

Web link to FHWA's MSAT guidance appendices for prototype language: https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/index.cfm

6.3.2 Projects with Low Potential MSATs Effects

Appendix B of FHWA's guidance includes example language for a qualitative assessment, with specific examples for four types of projects: (1) a minor widening project; (2) a new interchange connecting an existing roadway with a new roadway; (3) a new interchange connecting new roadways; and (4) minor improvements or expansions to intermodal centers or other projects that affect truck traffic. The information provided in the appendix must be modified to reflect the local and project-specific situation.

In addition to the qualitative assessment, a NEPA document for this category of projects must include a discussion of information that is incomplete or unavailable for a project specific assessment of MSAT impacts, in compliance with the Council on Environmental Quality (CEQ) regulations (40 CFR 1502.22(b)). This discussion should explain how air toxics analysis is an emerging field and current scientific techniques, tools, and data are not sufficient to accurately estimate human health impacts that would result from a transportation project in a way that would be useful to decision-makers. Also in compliance with 40 CFR 150.22(b), it should contain information regarding the health impacts of MSATs. Appendix C of FHWA's interim guidance assists in preparing this NEPA documentation.

Web link to FHWA's guidance on documenting incomplete or unavailable information (Appendix C):

http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/page03.cfm

6.3.3 Projects with Higher Potential MSATs Effects

The FHWA guidance does not provide specific template language for a quantitative MSATs analysis. If an analysis is required, a separate air quality technical report should be prepared as discussed for the CO and PM pollutants (see **Section 6.5**). Other documentation efforts should be defined and established through the interagency consultation process. At a minimum, the following sections should be included in a technical report and associated NEPA documentation:

- Background on MSATs;
- Summary of analytical methods and assumptions;
- Summary of traffic forecasts by analysis year and scenario;
- Tabulations of MSATs for each analysis year and scenario (Build / No-build);
- Incomplete or unavailable information (Per Appendix C of FHWA guidance); Mitigation strategies (if applicable); and Summary of analysis results.

6.4 NEPA Documentation for Regional Conformity Determinations

The following statements (or something similar) should appear under a conformity heading in NEPA documents. Typically the conformity section should appear as the last section of the air quality analysis documentation and should include the following background information:

- Brief description of what conformity is and reference to the latest final conformity rule (40 CFR Part 51).
- Attainment status of the project area
- Identify nonattainment status by pollutant, if applicable
- The name and title of the current TIP
- The date when the TIP was adopted by whom (MPO or Department)
- The date when the TIP was approved by FHWA

Web link to Conformity Rule: https://www.epa.gov/state-and-local-transportation/transportation-conformity

See **Figure 1** for appropriate MPO contacts regarding TIP and associated conformity analyses.

The following statements must also appear under the regional conformity section within the NEPA document: “The final conformity rule requires that transportation plans and programs in nonattainment or maintenance areas:

- Are consistent with the most-recent estimates of mobile source emissions;
- Provide for the expeditious implementation of transportation control measures in the applicable implementation plan; and
- Contribute to annual emissions reductions in nonattainment areas.”

6.5 Project-level Air Quality Report Content

For EAs, detailed air quality documentation should be included in the appendix and summarized in the document. For categorical exclusions evaluations (CEEs), Section A-6 should be filled out in the CE/EA

system and any other type of documentation (qualitative/quantitative) should be incorporated into the project file. For EISs, an air quality technical report should be prepared as a self-sufficient, stand alone, comprehensive document. The air quality analysis results and all relevant information should be summarized in the body of the EIS document. The EIS summary should reference the stand-alone air quality report.

Section 3.10 of EPA's *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (EPA-420-B-15-084) provides guidelines for preparing PM hot-spot analysis documentation. These guidelines may also serve as a guide for developing air quality reports for CO and MSATs. They include:

- A description of the proposed project, including where the project is located, the project's scope (e.g., adding an interchange, widening a highway, expanding a major bus terminal), when the project is expected to be open to traffic, travel activity projected for the analysis year(s), and what part of 40 CFR 93.123(b)(1) applies;
- A description of the analysis year(s) examined and the factors considered in determining the year(s) of peak emissions;
- Emissions modeling, including the emissions model used (e.g., MOVES), modeling inputs and results, and how the project was characterized in terms of links;
- Modeling inputs and results for estimating re-entrained road dust, construction emissions, and any nearby source emissions (if applicable to the pollutant of concern);
- Air quality modeling data, including the air quality model used, modeling inputs and results, and description of the receptors employed in the analysis;
- A description of the assumptions used to determine background concentrations;
- A discussion of any mitigation or control measures that will be implemented, the methods and assumptions used to quantify their expected effects, and associated written commitments;
- A description of how the interagency consultation and public participation requirements in 40 CFR 93.105 were met; and
- A conclusion (in the case of PM this would include how the proposed project meets 40 CFR 93.116 and 93.123 conformity requirements for the $PM_{2.5}$ and/or PM_{10} NAAQS).

In order to develop a consistent reporting style, PennDOT has developed the following outline structure when preparing an air quality analysis technical report.

- Introduction – The introduction should include a brief synopsis of laws governing air quality, a brief discussion on NAAQS, carbon monoxide and pertinent history / information about the project area.
- Methodology -- The methodology should include a complete description of the project and any alternatives (including the No-build alternative). This section should also include a discussion on the air quality modeling approach, computer programs used, pertinent guidance and any assumptions used for the analysis. Discussion on attainment status and the general air quality of the study area.

- Existing Conditions – The existing conditions section should include a discussion of background CO concentrations used / developed for the analysis and the calculated CO levels using existing traffic volumes and roadway geometry. As well as any information for the existing MSAT Affected Network, if applicable.
- Future Conditions – The future conditions section should include a discussion on CO levels as they relate to the NAAQS for opening and design year scenarios for each alternative under consideration (including the No-build). As well as a comparison for the No-build and Build MSATs analysis, if applicable.
- Conclusion – A brief conclusion section is recommended to summarize the results of the air quality analysis.

6.6 Technical File Requirements / Content

- Project Mapping with Receptors
- EPA Emission Model Input / Output Files
- CAL3QHC / AERMOD Input / Output Files
- Traffic Data Used in the Analysis
- Conformity Documentation
- Correspondence including memos prepared for ICG review
- List of Assumptions
- List of References

7.0 GHG EMISSIONS/CLIMATE CHANGE PROJECT-LEVEL ANALYSIS AND DOCUMENTATION

This section provides an approach for addressing GHG emissions and climate change impacts on the transportation system. Future legal action is expected related to these topics as some courts have already ruled that NEPA's requirement to assess indirect effects of a project extends to climate impacts. Utilizing this process, the Department's NEPA analyses will address these issues thereby ensuring minimal cause for future legal actions. Currently, no formal federal direction on this topic has been issued. PennDOT does not require any additional extensive work efforts nor do they require any additional studies to address climate change impacts. This guidance is intended to assist the PennDOT in determining under what circumstances they should consider climate change impacts and clarify the level of effort to complete the analyses. Most projects will not require a GHG analysis. The guidance has been developed to keep analyses to only those projects that may be significant. Analyses requires only the use of existing studies or data and does not require new information to be researched or developed. PennDOT has developed a standard analytical process and template for addressing GHG emissions and climate change in environmental documentation. It is expected that this guidance will evolve over time as new procedures, data and tools become available. A screening assessment should be conducted to determine whether a quantitative or qualitative GHG emission assessment is required for an individual project. In addition, PennDOT has developed a framework to qualitatively address project impacts and effects related to climate change. The results of these analyses are to be integrated into the NEPA documentation.

7.1 GHG Emissions Analysis Screening

GHG emission analyses should be limited to those projects that are anticipated to have significant transportation and/or construction impacts. The emission analyses are intended to disclose the potential GHG impacts of the project and may be used as a criteria to evaluate project alternatives. The level of analysis should be commensurate with available data. As such, GHG emission analyses should not alone justify the need for additional traffic data modeling and/or traffic analyses beyond that needed for other NEPA purposes. It is expected that quantitative analyses will only be conducted for major capacity increasing projects that could significantly increase regional vehicle miles of travel.

Analysis scoping should begin with a determination of the appropriate level of assessment for GHG emissions. Levels of assessment include:

- ***No Analysis Required*** – A GHG emissions analysis is not required for projects that have a minor impact on traffic and operations. These include projects classified as Categorical Exclusions (CE) and project types exempt from the transportation conformity analyses (see **Table 2**).

- ***Qualitative Assessment*** – A qualitative assessment of GHG emissions includes a discussion of the project's impact on vehicle miles of travel and traffic operations (i.e. travel speeds) and how those impacts may affect GHG emissions. The impacts over the project lifespan are also evaluated against potential levels of construction activity.

- ***Quantitative Assessment*** – A quantitative assessment builds upon the qualitative assessment with additional analyses demonstrating the emission impacts of the project. A quantitative assessment can be addressed using one of the following approaches:

  a. *Planning-Level Assessment* - Under this approach, reference may be made to a regional or statewide planning-level GHG analysis that includes the project of study as well as other planned projects and accounts for the interconnections between projects and the existing road network.

b. *Project-Level Assessment* – A project level assessment addresses the project's impact on GHG emissions related to construction activities and regional traffic changes. These assessments utilize tools including FHWA's Infrastructure Carbon Estimator and EPA's MOVES emission factor model.

PennDOT's current screening guidelines for determining an appropriate level of GHG analyses are shown in **Figure 5**.

Figure 5: GHG Analysis Level Screening Guidelines

STEP 1:		
Is the Proposed Project classified as a Categorical Exclusion (CE)?	Yes	**No GHG Emission Analysis Required**
	No	Continue to **Step 2**
STEP 2:		
Is the EA/EIS project exempt from transportation conformity per 40 CFR 93.126, 27 or 128?*	Yes	**No GHG Emission Analysis Required**
	No	Continue to **Step 3**
STEP 3:		
Is the project regionally significant according to the definition provided in the transportation conformity rule?**	Yes	Continue to **Step 4**
	No	**No GHG Emission Analysis Required**
STEP 4:		
Are traffic studies available for the project that support the assessment of project impacts on vehicle miles of travel (VMT) and/or travel speeds?***	Yes	Continue to **Step 5**
	No	**Conduct a Qualitative GHG Emissions Analysis**
STEP 5:		
Is regional modeling available that estimates increases to regional VMT based on the project construction?****	Yes	Continue to **Step 6**
	No	**Conduct a Qualitative GHG Emissions Analysis**
STEP 6:		
Has PennDOT or the MPO/RPO conducted a planning-level GHG assessment that includes the project?	Yes	**Conduct a Quantitative Planning-Level Analysis**
	No	**Conduct a Quantitative Project-Level Analysis**

** Transportation conformity exemption tables are provided in Section 1.7 (Table 2 and 3)*
*** Regionally Significant: Transportation Project (other than an exempt project) that is on a facility which serves regional transportation needs (e.g., access to and from the area outside of the region, major activity centers in the region, major planned, or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network, including at a minimum: all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel.*
**** Traffic data availability may vary by alternative. Preliminary alternatives without data can be evaluated qualitatively. Traffic data includes information on future traffic volumes with the project constructed and associated impacts on vehicle speed and operations. If information is only available for certain peak periods, then the GHG emissions for only those periods should be estimated.*
***** Projects with no or minimal (e.g. <5%) VMT increases should not significantly increase GHG emissions. As such a quantitative analysis is only required for projects that increase regional VMT by more than 5%. Estimates of regional VMT may require a travel demand model. If regional estimates are not available, then VMT may be assessed for the corridor of analysis.*

As referenced in Step 4 of the screening guidelines, detailed transportation data is needed to conduct a GHG emissions analysis. If the NEPA study does not include traffic analyses that can support the development of the required traffic data then a qualitative analysis is recommended. Transportation data required for quantitative GHG emission analyses include:

- Regional or project-level travel modeling to determine changes in VMT for the base, *No Build* and *Build* scenarios for relevant facilities impacted by project improvements
- Analyses estimating peak and off-peak travel speeds along the roadway and other impacted facilities for each scenario

7.2 Qualitative GHG Assessments

A qualitative assessment documents, in narrative form, the potential project impacts on GHG emissions and consists of a project description, a general overview of GHG emissions and project impacts (positive or negative) on emissions from both the *No-build* and *Build* alternative(s). For most transportation projects, it is anticipated that the project will not negatively impact regional GHG emissions. In specific, the qualitative description should highlight the description of the project benefits to traffic operations including:

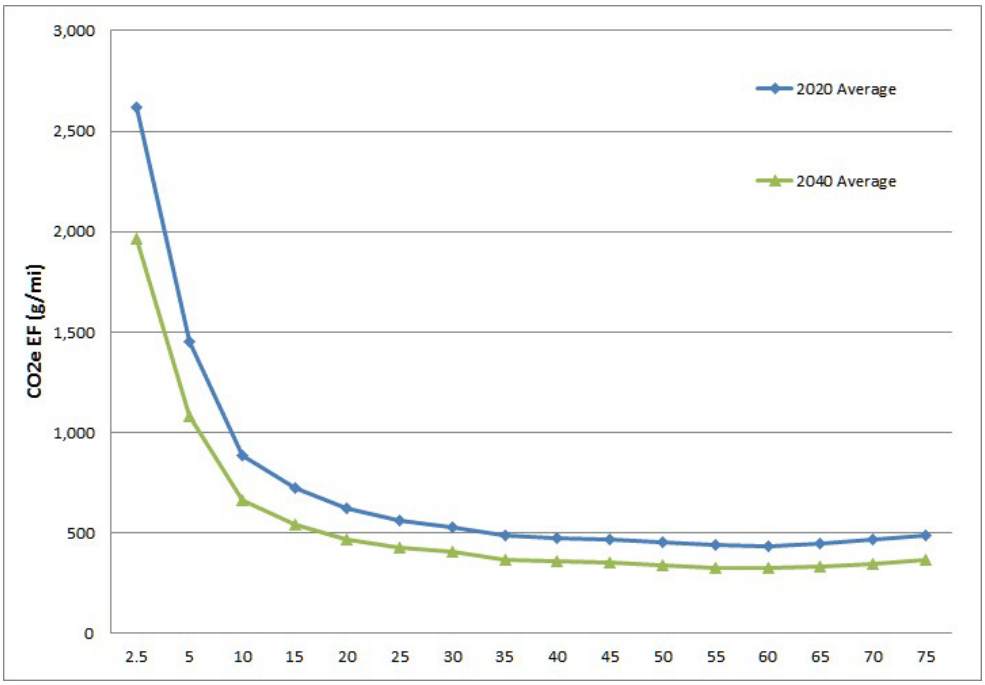
- Reducing stop and go conditions;
- Improving roadway speeds to a moderate level;
- Improving intersection traffic flow to reduce idling;
- Creating more safe and efficient freight movement;
- Expanding transit and non-motorized options for travelers;
- Increasing the reliability of transit and HOV travel times; and
- Increasing vegetation density over pre-project conditions to sequester carbon

The qualitative analysis may refer to **Figure 6**, which illustrates the relationship between speed and emission rates for carbon dioxide equivalent (CO2e), a standard measurement for measuring GHG emissions. Rates are displayed for 2020 and 2040 and represent the average emission rates for all vehicle and roadway types in Pennsylvania. Rates for 2040 show an overall average decrease of 25 percent over the 2020 rates. Reductions in GHG emissions associated with congestion would result from the project due to the congestion reduction and increase in actual operating speeds.

The qualitative analysis should also address construction activities including the expected timeframe of such activities. The GHG emissions produced from short term construction emissions may be offset by the longer term benefits of the project. PennDOT will continue to evaluate supporting text and documentation to assist with qualitative discussions of construction emissions. At this time, these discussions may focus more on disclosing the level of construction activities required for the type of project.

Figure 6: CO2e Emission Rates by Speed

2020 and 2040 CO2e Composite Running Emission Rates by Speed (mph)
Based on MOVES2014a MOVESDB20151201 – for sample Pennsylvania County



7.3 Quantitative GHG Assessments

At this time, PennDOT has not established specific protocols for quantitative analyses. As a result, the analysis detail and form may vary by project based on the available information. The scope and detail of the analysis should be identified early in the NEPA process to allow PennDOT sufficient time to provide comments and insights on the procedures and data sources to be used.

7.3.1 Quantitative Analysis Options

As discussed in **Section 7.1** and **Figure 5**, there are two options for conducting a quantitative analysis:

a) *Planning-Level Assessment* - Under this approach, reference may be made to a regional or a statewide planning-level GHG analysis that includes the project of study as well as other planned projects and accounts for the interconnections between projects and the existing road network. At this time, planning-level assessments are not available. The MPO/RPO covering the project location may be consulted to determine if a formal GHG analysis and report have been completed that includes the associated project of study. A planning level assessment may not specifically address constructions emissions. In these cases, constructions emissions may be discussed qualitatively.

b) *Project-Level Assessment* – A project level assessment addresses the project's impact on GHG emissions related to construction activities and regional traffic changes. These analyses utilize tools including FHWA's Infrastructure Carbon Estimator and EPA's MOVES emission factor

model. If the project characteristics or traffic data needed by these tools are not available, then a quantitative analysis is not required, as it may not be reflective of the actual project impacts.

7.3.2 Quantitative Project-Level Analysis Components

PennDOT is recommending the use of several tools that have been developed nationally to support GHG emissions analyses for the transportation sector. A project-level quantitative analysis should be performed on any project that the screening analysis (**Figure 5**) determined appropriate. A quantitative analysis should include:

- Analysis of CO2e emissions from the *No-build* and *Build* alternatives
  - Emission sources including the following:
    - Operations (Tailpipe) – Base and Design Year
    - Construction
- A discussion on mitigation measures

7.3.3 Quantitative Project-Level GHG Analysis Tools

Two assessment tools are recommended for project-level quantitative GHG analyses: the Environmental Protection Agency (EPA) Motor Vehicle Emission Simulator (MOVES) tool (for Operation Emissions), and the FHWA Infrastructure Carbon Estimator (ICE) tool (Construction Emissions).

Operation Emissions - EPA MOVES

This analysis tool is appropriate for estimating operation emission sources (tailpipe) for the base and design year. MOVES is a "state-of-the science emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gases, and air toxics." Additional information regarding EPA MOVES can be found in **Section 2.3.1**. The project level analysis should use the most current version of the MOVES model for operational emissions. EPA has guidance available for the application of the MOVES model for estimation of GHG emissions.

CO2e emissions should be quantified for the project *Build* alternatives (i.e., emissions from vehicles using the proposed facility) versus the *No Build* alternative. A comparison of the emissions of the *Build* and *No-build* alternatives may be developed using a MOVES Emission Rate Lookup Table (ERLT) and projected vehicle miles traveled (VMT) for the design year of the project. For projects within the boundary of a metropolitan planning organization (MPO), this is normally the last year of the MPO's 20-year plan.

EPA Guidance for Using MOVES to Estimate GHG can be found at https://www.epa.gov/moves

Construction Emissions – FHWA ICE Tool

FHWA's Infrastructure Carbon Estimator (ICE) is a spreadsheet tool that estimates the lifecycle energy and greenhouse gas emissions from the construction and maintenance of transportation facilities. It estimates and reports emissions from "construction equipment" and "upstream emissions" from "materials." The Estimator requires limited data inputs and is designed to inform planning and pre-engineering analysis. This tool requires basic project information

FHWA ICE Tool:

https://www.fhwa.dot.gov/environment/sustainability/energy/tools/carbon_estimator/index.cfm

such as lane miles and Annual average daily traffic (AADT), and has many additional optional inputs.

7.3.4 Quantitative Project-Level GHG Data Needs

To conduct the quantitative GHG analysis, data from various sources will be required and should be documented for both the No-build and Build Alternative(s). Data needs include but are not limited to:

- **Detailed Traffic and Speed Data**: Includes design speeds (No-build and Build Alternatives).
- **VMT**: Vehicle miles traveled (per year)
- **Emission Rates By Speed**
- **CO2e Tailpipe Emissions**
- **Fuel Cycle Emissions**
- **FHWA ICE Tool Inputs –** detailed plans/schematics of the proposed project (e.g., bridge crossings, lengths, new pavement, proposed sidewalks, etc.)

7.4 Mitigation

Mitigation measures are not specifically required for GHG emission reduction due to the current uncertainties regarding available analysis approaches and methods. Mitigation may be discussed in context of regional and/or national efforts. If specific project characteristics are known that may relate to potential reductions in GHG emissions during construction or through improve traffic operations, then those items may also be discussed. PennDOT EPDS should be contacted regarding the level and detail of any proposed project-specific mitigation measures and the documentation of those measures in the NEPA document.

The FHWA ICE tool includes project level (roadway system) mitigation measures that can be implemented to reduce GHG emissions from construction and maintenance activities. However, details regarding construction equipment and materials are typically determined during the design, construction, and postconstruction phases; therefore no commitments to GHG reduction strategies would be made during the NEPA/development phase. Examples of potential mitigation strategies listed in the ICE tool include:

- Alternative Fuels and Vehicle Hybridization;
- Vegetation Management;
- In-Place Roadway Recycling;
- Use of Warm-mix asphalt;
- Use of Recycled and Reclaimed Materials; and Preventative Maintenance.

Regional and national mitigation measures that may be discussed include:

- **Regional Reduction Initiatives:** Document regional (or statewide) reduction efforts, such as initiatives identified in the Pennsylvania Climate Action Plan.
- **National Programs:** The USDOT and EPA have jointly established new, more stringent fuel economy and the first-ever GHG emissions standards for model year 2012 to 2025 cars and light trucks. By model year 2025, the ultimate fuel economy standard is 54.5 miles per gallon for cars and light trucks. Further, on September 15, 2011, the agencies jointly published the first-ever fuel economy and GHG emissions standards for heavy-duty trucks and buses. The objective of this group of strategies is to use less fuel and generate fewer GHG emissions.

The Pennsylvania Climate Action Plan can be found at https://www.pa.gov/agencies/dep/residents/climate-change.html

7.5 Assessment of Climate Change Effects

Climate change effects should consider both the impacts of climate change on the proposed project as well as the effects on the affected environment, particularly resources potentially impacted by the project that may also be affected by climate change. At this time, there is a considerable amount of research and data development underway related to these topics. PennDOT recommends a qualitative assessment utilizing resources and data that are readily available. This may include state or regional studies, national research, and project-specific data from other NEPA sections. PennDOT does not require any extensive work efforts or additional studies to address climate change impacts.

7.5.1 Disclosure of Potential Climate Impacts

Available data resources should be utilized to assess potential climatic trends of key climate variables including temperature and precipitation, and sea level rise (applicable to southeastern Pennsylvania, only). Historical, current and future trends of these variables should be assessed, including (if available):

- number of "hottest days" per year
- annual mean maximum temperature
- days over 100 degrees
- heavy precipitation days
- consecutive dry days
- annual mean precipitation
- annual mean runoff, soil storage, evaporative deficit
- sea-levels (if applicable)

Key data resources that can be used include online data tools from the United States Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), and information from the Pennsylvania Climate Impacts Assessment study. The USGS and NOAA tools can be used to identify climatic trends for the county or area where the project is located. The Pennsylvania Climate Impacts Assessment documented that warmer temperatures, more precipitation, and longer dry periods will be evident in most parts of Pennsylvania. Specific references and tables can be extracted from this document.

Climate Forecast Data Resources:

USGS: https://www.usgs.gov/tools/national-climate-change-viewer-nccv

NOAA Climate Explorer: https://toolkit.climate.gov/climate-explorer2/

Pennsylvania Climate Impacts Assessment: https://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/Climate%20Change%20Advisory%20Committee/2023/8-22-23/ICF-Presentation_to_CCAC_10.24.23.pdf

7.5.2 Assessing Impacts of Climate Change on the Project

The qualitative analysis should also disclose and assess the potential impact that climate change may have on the project or the selection of alternatives. Key sources of information that may be integrated into the analysis include:

- Table I.1 from the Transportation Research Board's NCHRP Report 750 titled *Climate Change, Extreme Weather Events, and the Highway System* http://www.trb.org/Main/Blurbs/169781.aspx

- Transportation infrastructure vulnerabilities highlighted in Appendix A of the PaDEP Pennsylvania Climate Adaptation Report https://greenport.pa.gov/elibrary/PDFProvider.ashx?action=PDFStream&docID=6636&revision=0&docName=PENNSYLVANIA+CLIMATE+ADAPTATION+PLANNING+REPORT&nativeExt=pdf&PromptToSave=False&Size=9741364&ViewerMode=2&overlay=0

Precipitation and Flooding Assessment

Increases in the number and intensity of extreme precipitation events is expected to be the primary climate concern addressed within the NEPA process for Pennsylvania projects. Both the *No-build* and *Build* alternative(s) should be assessed for potential impacts including: structural integrity of roads/bridges compromised due to increased soil moisture levels, damage to culverts/roads near flood zones during heavy precipitation events, road embankment damage potential, etc. An assessment of increased flooding should also address the expected lifespan of the project in context to climate change forecasts; the potential or need for higher design standards to improve resiliency, the evaluation if some alternatives provide increased resiliency, and an evaluation of historic flooding events and impacts within the study area.

PennDOT has completed an Extreme Weather Vulnerability Study that can serve as a resource for project evaluation. The mapping products from that study include a historic assessment of flooding on state roadways. In addition, forecast flooding scenarios have also been developed for several pilot counties. PennDOT anticipates expanding these scenario analyses to more counties in the future.

PennDOT Extreme Weather Vulnerability Study: https://pennshare.maps.arcgis.com/

Assessing Other Climate Impacts

Projects located in southeastern Pennsylvania within the Delaware Estuary should also address and document the impact NOAA Technical Report of sea level rise on the proposed project. A discussion should NOS CO-OPS 083: include how structures in the *No-build* and *Build* alternatives would be impacted by higher water depths. In January 2017, NOAA released the *Global and Regional Sea Level Rise Scenarios for the United States* report. This report was written in collaboration with a number of federal agencies and academia and builds upon past sea level rise work from NOAA, USACE, and the IPCC. Within the report, Table 5 provides the different sea-level rise scenarios and Section 6 addresses how to interpret these scenarios within a risk-based context. The NOAA report also includes data for regional sea level rise on a 1-degree grid covering the coastlines of the United States. The regional sea level rise projections are available for all six global sea level rise scenarios as well as low, median, and high sub-scenarios.

The effects of extreme heat and/or higher temperatures are expected to be of less concern in Pennsylvania, especially in context of the potential infrastructure lifespan. Special considerations to temperature may be addressed on a project basis, especially if high temperatures have caused historic impacts in the study area. Examples of potential heat impacts include potential acceleration of pavement degradation rates, increased roadway maintenance, bridge deterioration, additional construction costs, etc.

NOAA Technical Report NOS CO-OPS 083: https://tidesandcurrents.noaa.gov/pub.html

Report and Data provided as separate publication links available at the above website.

7.5.3 Effects on the Affected Environment

Qualitative analyses may incorporate existing information about climate effects on the affected environment if they may impact the transportation project alternative selection or design. At this time, PennDOT has limited resources and guidance to assist with documenting the impacts of climate on the affected environment. As such, this assessment is considered optional. An assessment may include socioeconomic or natural resources that are impacted by the project (e.g., wetlands, floodplains, public facilities, residences, etc.) and is expected to vary depending on an individual project and associated impacts.

7.5.4 Adaptation and Resiliency

Resilience is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions. Based on the climate stressors provided above, adaptation and resiliency strategies may be considered during the post NEPA design, construction and maintenance activities to reduce risks to climate change.

This NEPA-level climate assessment may lack the necessary information to recommend specific adaptation strategies. As a result, the assessment may more simply disclose potential vulnerabilities and recommend that adaptation strategies be considered in post NEPA activities. As an example, NEPA assessments could recommend that the proposed project be designed in accordance with applicable design requirements such as the FHWA's 2016 guidance *HEC-17: Hydraulic Engineering Circular 17: Highways in the River Environment - Floodplains, Extreme Events, Risk, and Resilience (or HEC-25: Hydraulic Engineering Circular 25, Vol. 2: Highways in the Coastal Environment: Assessing Extreme Events).* Adaptation and resiliency could also be addressed through recommendations regarding bridge heights, information from hydrologic and hydraulic studies performed during NEPA, and/or information on floodplain coordination as addressed in other sections of the NEPA document.

7.6 Incomplete or Unavailable Information

The GHG emission and climate assessments as recommended within this document are included to disclose potential impacts of the project. Although the analyses are based on the best available data, the outcomes are affected by limitations in the data available and uncertainties that limit the accuracy of the tools used. This section describes key limitations to the analyses and these limitations may also be addressed within the NEPA document.

7.6.1 Limitation of GHG Emissions Analysis

A level of uncertainty exists in the estimation of a project's impact on greenhouse gas emissions. This uncertainty results from limitations in travel demand forecasting, traffic operation analyses, and emission factor modeling. Travel demand modeling is used to forecast traffic volumes and diversions related to transportation projects. Uncertainty surrounds the travel choices, demographic futures, and other modeling parameters that serve as the foundation of the model development. The estimation of travel speeds remains an important step in the process, as emissions vary significantly by vehicle operation. Travel speeds are typically estimated using statistical relationships accounting for traffic volume, the roadway capacity and free-flow speeds. These relationships may not fully represent the actual traffic conditions at specific locations. Although EPA's MOVES emission factor model provides the best available tool for conducting different types of transportation GHG analyses, there is some uncertainty with many of the model's input files many of which are based on national defaults. Application of composite emission rates does not fully consider detailed location-specific vehicle operations including accelerations and decelerations, the variances by specific vehicle types by model year, and the variances by different road conditions and function.

The ICE tool includes many factors and assumptions which are summarized in Section 5 of the FHWA Infrastructure Carbon Estimator Final Report and User's Guide. The tool incorporates estimates of the typical volumes of materials and amount of on-site construction activity associated with building various types of facilities, such as an urban freeway, an at-grade rail line, or an offstreet bike path. The assumptions are based on data from a broad sample of projects. With a few exceptions related to mitigation strategies, the tool does not analyze the impacts of any project elements that would be specified during development of detailed design, engineering, and construction plans. Construction emissions were estimated based upon broad national assumptions provided by the FHWA ICE tool and may not accurately estimate construction emissions because construction decisions occur post-NEPA.

7.6.2 Limitation of Climate Models

Climate science is highly complex and evolving, and climate models incorporate many different assumptions. Most models rely on past patterns to calibrate results; however, one of the challenges associated with climate change is that the future is not expected to follow the patterns of the past, which makes it difficult to assess the accuracy of the models. Additionally, the models are intended to analyze the global climate, and results must be scaled down to assess climate predictions at a more local level. The combination of assumptions, uncertainty of model results, and scaling mean that it is not possible to credibly assess climate impacts directly attributable to GHG emissions associated with a specific proposed project.

Future uncertainties are real and pose challenges to engineering as evidenced by the findings in the FHWA Assessment of Key Gaps in the Integration of Climate Change Considerations into Transportation Engineering. According to the study, the four primary gaps facing state DOTs/MPOs are:

- Translation of climate data to terms that resonate with transportation practitioners;
- Engineering solutions for preparing for climate change;
- Methods for evaluating efficacy and costs/benefits of implementation adaptation measures, and
- Organization process/decision-making.

7.6.3 Limitations Regarding Impacts on Human Health

In addition, impacts of climate change on human health is also an area of uncertainty. The U.S. Global Change Research Program (USGCRP) released a report "*The Impacts on Climate Change on Human Health in the United States A Scientific Assessment*" (https://health2016.globalchange.gov) that includes a discussion of potential health impacts and a likelihood and confidence evaluation of each key finding.

7.7 NEPA Documentation of GHG/Climate Change Assessment

7.7.1 Projects That Do Not Require Analysis

As outlined in **Section 7.1**, many projects will not require a GHG analysis or assessment. These include projects classified as CE, exempt from transportation conformity, or otherwise considered not regionally significant. Section A-6 (under "Additional Information") should include the following statements:

"The subject project has been identified as being exempt from GHG Emission/Climate Change analysis per Pub 321 and therefore, no further analysis is required."

7.7.2 Projects with Qualitative GHG Analyses and Climate Change Assessment

For all projects in which a qualitative GHG analysis has been conducted, documentation in the NEPA document should be prepared; a separate technical report is not required. The GHG/Climate Change section of the NEPA document, at a minimum, should include:

- Brief background of GHG, vehicular contribution to GHG emissions, and Climate Change
- Most recent data regarding GHG Emissions by Industry Sector (if available)
- Methodology employed to determine that qualitative GHG analyses were applicable to the project
- Projects impacts on GHG emissions (such and improving or not increasing emissions)
- Anticipated construction related GHG emissions including duration of construction
- Qualitative overview of climate impacts and adaptation strategies and include sections describing the analyses completed for: Impacts of Climate Change on a Project and Impacts on the Affected Environment
- General discussion of potential adaptation/mitigation strategies, as appropriate for the complexity and regional setting of the project
- Statement(s) regarding the unavailability or incomplete data for the project specific assessment as well as the uncertainties surrounding the science of climate change as described in **Section 7.6** (Note some of Section 7.6 is applicable only to tools used for quantitative analyses)

Conclusions

- References/Sited Data Sources

Although emissions and climate change impacts will not be quantified, a consistent approach should be followed to ensure that the relevant aspects of every project are adequately addressed. Template language is included in **Appendix 2** as a supplemental resource.

7.7.3 Projects with Quantitative GHG Analyses and Climate Change Assessment

When a quantitative GHG analysis is performed, the NEPA document should summarize the results and methodology of the analysis with supporting data supplied in a project-level GHG/Climate Change Assessment technical report. The GHG/Climate Change Assessment Technical Report should be prepared as a self-sufficient, stand alone, comprehensive document. The GHG analysis results and all relevant information should be summarized in the body of the NEPA document. Specific sections should include those as documented in Section 7.7.2 above and the following:

- Methodology employed for GHG Emissions calculations
- List of emission calculation tools used (e.g., MOVES)
- Project impacts on GHG emissions (e.g., improving or not increasing emissions) with data summary tables for both No-build and all Build Alternative(s)
- Anticipated construction related GHG emissions with reference to FHWA ICE Tool results
- Conclusions
- References/Sited Data Sources

A consistent approach should be followed to ensure that the relevant aspects of every project are adequately addressed in both the NEPA document summary as well as the stand along technical report. Template language and format for both is included in **Appendix 2** as a supplemental resource.

APPENDIX 1

PM Project-level Conformity LEVEL 3 Screening Template

PM Project-Level Air Quality Conformity Determination
Level 3 Screening Support Document

[*Insert project name*]
[*County name*], Pennsylvania

[*Preparing Agency/Consultant and Date*]

I. Background

which falls within the [*nonattainment or maintenance area*
The [*project name*] is located in [*county name*]]) area. Effective April, 2012, the U.S. Environmental *name*] ate matter ([$PM_{2.5}$ *or* PM_{10} Protection Agency (EPA) published a Final Rule (40 CFR §93.116) that establishes transportation conformity criteria and procedures for determining which transportation projects must be analyzed for local air quality impacts in particulate matter nonattainment and maintenance areas. The rule was followed by a guidance document issued by the EPA and the Federal Highway Administration (FHWA) that provides the information for state and local agencies to meet the hot-spot requirements established in the conformity rule.

PennDOT's Publication 321 provides the procedures for screening transportation projects for particulate matter hot-spot analyses. The screening process includes three levels to determine if a project is of "air quality concern". Level 1 and 2 screening can be conducted solely by PennDOT District staff according to the procedures and thresholds in Publication 321. Projects that cannot be screened using the Level 2 thresholds are submitted to PennDOT's EPDS. The EPDS is responsible for compiling available project information and distributing it to with the *Pennsylvania Air Quality Workgroup* (i.e. the statewide interagency consultation group consisting of PennDOT, EPA, FHWA, FTA, PaDEP and MPO representatives). This Level 3 screening includes the review and discussion of project information by the interagency group, which then decides whether the project is of "air quality concern" thus requiring a formal hot-spot analysis.

This document provides supporting information needed to conduct the Level 3 screening review. It includes a project description, traffic data, project location information and other pertinent data needed to conduct an assessment. This document, in itself, is not a formal hot-spot analysis. Such an analysis will need to be completed according to federal guidance if the Level 3 screening concludes that the project is of "air quality concern". Currently a formal hot-spot would be qualitative in nature; however, beginning December 20, 2012, a quantitative hot-spot analysis is required using EPA's Motor Vehicle Emission Simulator (MOVES) model.

II. Project Description

Location and extent of project including project map]
Project type and scope]
Year open to public]
[Description of preferred alternative including diagram of improvements

III. Summary of Project Objectives

[*Provide summary bullet points addressing key objectives and goals of project*]
[*If appropriate, provide summary map indicating multiple objectives (e.g. locations where safety, capacity, accessibility, access management, and truck travel improvements are focused)*]

IV. Current Project Area Conditions

This section includes a discussion of available information on current air quality, traffic and land use conditions in the project area.

Air Quality

The [*nonattainment/maintenance area name*] includes [*list all counties/townships in area if applicable*]. The closest monitors to the project include [*list monitor locations*] which are approximately [*distance of each monitor from project location*] miles from each monitor location respectively. The following tables illustrate recent monitor trends based on EPA-verified data obtained from EPA's AirData website (http://www.epa.gov/airdata/).

[*Summarize monitor data for Annual and Daily $PM_{2.5}$ using EPA AirData for the 3 most recent years of data available*]

$PM_{2.5}$ Monitor Annual Mean Concentration (ug/m^3)

Monitor Reference	Distance from Study Area	[ ] *Year 1* Mean Value	[ ] *Year 2* Mean Value	[ ] *Year 3* Mean Value	3-Year Average

$PM_{2.5}$ Monitor Daily (24-hour) 98th Percentile Concentration (ug/m^3)

Monitor Reference	Distance from Study Area	[ ] *Year 1* 98th Percentile	[ ] *Year 2* 98th Percentile	[ ] *Year 3* 98th Percentile	3-Year Average

Traffic / Transportation

Specify current traffic conditions and congestion levels (e.g. LOS if available) []
Include base year AADT traffic volumes and truck volumes]
Locations of any truck idling (e.g. rest stops, intermodal centers, etc.)]
If available, provide map illustrating congested corridors or locations]

Natural Environment

Identify land use within study area (residential, commercial, industrial, and agricultural)]
If known, identify other significant background sources (e.g. major factories, point sources)

Sensitive Receptors

[*Identify any sensitive receptors (e.g. schools, hospitals, licensed daycare facilities, and elderly care facilities) within 1 mile of the project study area. Indicate their approximate distance from project*]

V. Project Impact on Future Conditions

The effect of the [*project name*] on future traffic conditions for the project's opening and design year is discussed in the following sections. Available quantitative and qualitative insights on project impacts have been compiled from the following resources:

Identify traffic studies or reports used]
Identify dates of studies]
Identify forecasting tools used (e.g. MPO regional travel demand model)

Forecast Traffic Volumes [*if available*]

The following table illustrates the impact of the transportation project on total highway and truck traffic volumes within the study area. This information was compiled from available traffic studies as listed above.

Project Impact on Future Traffic Conditions
[*Multiple tables may be needed if project encompasses several facilities or if volumes vary by section*]

	Total Traffic (AADT)		**Truck Traffic (ADTT) Scenario***	
	[*Year*] Opening Year Volume	[*Year*] Design Year Volume	[*Year*] Opening Year Volume	[*Year*] Design Year Volume
No-build	[xxxx]	[xxxx]	[xxxx] [%]	[xxxx] [%]
Build	[xxxx]	[xxxx]	[xxxx] [%]	[xxxx] [%]
Difference	[*Build-NoBuild*]	[*Build-NoBuild*]	[*Build-NoBuild*]	[*Build-NoBuild*]

[*if pertinent]* This project also has significant impacts on regional travel routing and is expected to [increase / decrease] overall) VMT within the region. [*provide additional detail documenting project impact on regional VMT*]

Forecast Traffic Congestion [*if available*]

Available studies have provided potential project impacts on regional congestion measures including roadway and intersection level of service (LOS).

Provide table illustrating available data; highlight differences between No-build and Build conditions
Discuss impacts of project on truck idling]

Qualitative Assessment of Project Impacts

[*Discuss project impacts on VMT and congestion and how that could impact air quality (e.g. does the project increase VMT, does it improve congestion, reductions in idling delay may offset any emissions due to increases in traffic volumes)*]

[*Projects that divert traffic volumes or facilitate new development may generate additional fine particulate matter emissions in the local project area; however, such activity may be attracted from elsewhere in the region. As a result, on a regional scale, there may be no net change in emissions or potentially an overall benefit from this project. The above data may not eliminate the need for potential mitigation measures within the project vicinity but should certainly be considered in the evaluation of the project.*]

Any changes to that will impact natural environment that could impact dispersion of PM []
Discuss future trends in development within project vicinity]

Other Mitigating Factors

[*Discuss potential non-highway improvements including transit and park-and-ride lots that will be completed in the project timeframe that may lead to reduced VMT or emissions within the study area*]

VI. Summary of Resources

List all pertinent project documentation and resource materials []
Provide web links if available]

APPENDIX 2

GHG Emissions and Climate Change Evaluation Templates

Appendix 2:

Templates have been developed to provide examples of how GHG emissions and climate change may be addressed within the NEPA document. The templates provide example language and sample evaluations. Analyses will vary on a project basis. As such, this template may not be applicable or representative of all project types or locations.

Template 1: Qualitative GHG Emissions Analyses and Climate Change Assessment
(For Inclusion in EA or EIS Document)

In the future, templates may also be developed by PennDOT for a Quantitative GHG Emissions Analyses and Climate Change Assessment

Template 1: Qualitative GHG Emissions Analyses and Climate Change Assessment

Introduction and Background

Under the National Environmental Policy Act (NEPA) of 1969, federal agencies (such as the Federal Highway Administration) are required to consider and disclose the potential effects of their actions and decisions on the environment. Within the NEPA context, the Pennsylvania Department of Transportation (PennDOT) has established a framework to address climate change and greenhouse gas (GHG) emissions[2]. This framework includes a GHG emissions analysis as a proxy for the project's impact to climate change and an assessment of the effects climate change may have on the proposed action and its environmental impacts considering available research and data. The purpose of this assessment is to provide decision makers and the public an overview of potential climate impacts for each of the project alternatives, and in turn, assist agencies in considering the need for measures to mitigate the impacts of climate change.

According to the Environmental Protection Agency (EPA), GHG emissions from the transportation sector account for about 26 percent of total U.S. greenhouse gas emissions, making it the second largest contributor after the electricity sector[3]. To date, no national standards have been established regarding GHGs, nor has the EPA established criteria or thresholds for ambient GHG emissions. However, a considerable body of scientific literature exists addressing the sources of GHG emissions and their potential impacts on climate change, including reports from the Intergovernmental Panel on Climate Change (IPCC), the National Academy of Sciences, EPA, and other federal agencies. Transportation projects have the potential to contribute to climate change by producing GHG emissions. GHG emissions typically result from direct sources (e.g., vehicular "tailpipe" emissions, fuel refining, etc.) and construction/maintenance activities (e.g., roadway construction and maintenance).

Historic changes in the climate have been documented by researchers including changes in temperature, precipitation, storm activity, sea level, and wind speeds. When climatic activity results in an effect on the human and/or natural environments they are often referred to as climate "stressors". Since transportation infrastructure is designed to withstand locally expected climate stressors of the magnitude and frequency that have historically been experienced, the risks from climate change can come from an amplification of existing stressors.

Methodologies

This project assessment on GHG emissions and climate change has been conducted based on the procedures and methods provided in PennDOT's *Project-Level Air Quality Handbook* (Pub 321). A qualitative GHG analysis has been conducted per the screening criteria provided in Pub 321. The project is not expected to have significant impacts on regional vehicle miles of travel (VMT) and all the alternatives are located within the existing interstate right-of-way. The project's impact on GHG emissions was assessed based on expected project outcomes and the results of available traffic analyses.

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[2] Climate change refers to any substantial change in measures of climate (such as temperature, sea level or precipitation) lasting for an extended period (decades or longer). Climate change may result from natural factors and processes or from human activities (EPA 2014). "Greenhouse gases" were named for their ability to trap heat (energy) like a greenhouse in the lower part of the atmosphere. The primary gases produced by the transportation sector are Carbon Dioxide (CO2), Methane (CH_4), Nitrous oxide (N_20), and hydrofluorocarbons (HFC).

[3] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

A qualitative assessment of climate change effects on the project was also considered using the data sources provided in Pub 321 including the 2015 Climate Change Action Plan Update[4][5], Pennsylvania Climate Impacts Assessment[iv], National Oceanic and Atmospheric Administration (NOAA) Climate Explorer Tool [v], Pennsylvania Climate Adaptation Planning Report [6], and the PennDOT Extreme Weather Vulnerability Study[vii]

The Pennsylvania Climate Change Act (PCCA), Act 70 of 2008 directed Pennsylvania's Department of Environmental Protection (DEP) to conduct a study of the potential impacts of global climate change on Pennsylvania over the next century. The study resulted in two reports: the Pennsylvania Climate Change Action Plan and the Climate Impacts Assessment (both updated in 2015). A complementary study prepared by DEP, the Pennsylvania Climate Adaptation Planning Report, focused on identifying adaptation strategies to increase the resiliency of the state' infrastructure and resources and will be integrated into future updates of the Climate Change Action Plan. The NOAA Climate Explorer Tool offers customizable graphs and maps of observed and projected temperature, precipitation, and related climate variables for every county in the contiguous United States. PennDOT's Extreme Weather Vulnerability Study focuses on the evaluation of historic vulnerabilities, development of a framework for addressing climate change impacts, and an initial assessment of risks and priorities related to the identified vulnerabilities. The study's analyses and mapping products are focused primarily on the flooding impacts on state-owned roads and bridges.

It should be noted that there are several major sources of uncertainty inherently included in the data source projections regarding climate change, such as the effects of natural variability, future human emissions, sensitivity to GHG emissions and natural climate drivers.

Project GHG Emissions Assessment

According to the 2015 Climate Change Action Plan Update, emissions attributed to the transportation sector result from fuels combusted to provide transportation for various types of vehicles within the Commonwealth including gasoline, diesel, jet fuel, and natural gas. Several factors will have an effect on the future amount of a fuel consumed including VMT, modal shifts, vehicle efficiency, and the price and availability of a particular fuel. According to the study projections, the transportation sector GHG emissions will decrease by approximately 13% between 2015 and 2030.

As summarized in [Table X], the primary objectives and expected outcomes of the [Project Build Alternatives] would support the reduction of GHG emissions over the infrastructure's life span. GHG emission reductions will also be supported through national strategies including USDOT's more stringent fuel economy and GHG emissions standards starting in 2012 model year vehicles. Under the "No-build" alternative, [Project Road] would not be [type of improvement] and traffic operations would continue to deteriorate and operate at a deficient Level of Service (LOS) during peak periods. A full accounting of the GHG emissions over the lifecycle of transportation facilities requires consideration of ongoing construction and rehabilitation needs. It is anticipated that the maintenance activities under the "Build" alternatives

[4] http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-/FINAL%202015%20Climate%20Change%20Action%20Plan%20Update.pdf
[iv] http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-108470/2700-BK-DEP4494.pdf
[v] https://toolkit.climate.gov/
[6] http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-103584/2700-RE-DEP4303%20Combined.pdf [vii] http://s3.amazonaws.com/tmp-map/climate/index.html

would not be significantly higher than that for the existing roadway. It is also anticipated that construction emissions would be offset by significant benefits to vehicle operation over the facility life.

Table [X]: Project Outcomes That Support Reduction in GHG Emissions

Outcomes of Project	Benefits to GHG Emissions
Reduced traffic congestion due to additional travel lane	[Discuss projected LOS levels]. [Discuss benefits of build alternatives to vehicles speeds, delays, etc.] nission rates from EPA's MOVES2014 model, - vill be redu build" conditions. "No
Reduction in crashes due to additional travel lane and interchange improvements	[Discuss crash rate data]. [Discuss improvements to safety, if applicable]
Reduced construction delays due to additional travel lane	[Discuss disruption to traffic during constructions and any methods employed to reduce construction-related GHG emissions.].

Assessment of Climate Change Effects on Project

The *Pennsylvania Climate Impacts Assessment* indicates that the state has undergone a long-term warming of more than 1.8°F over the past 110 years, interrupted by a brief cooling period in the mid-20th century. Pennsylvania shows a decreasing number of very dry months and an increasing number of very wet months, which reflects an overall wetting trend.

According to future modeling, Pennsylvania will be about 5.4°F warmer than it was at the end of the 20th century. The corresponding annual precipitation increase is expected to be eight percent with a winter increase of 14 percent. The likelihood for meteorological drought is expected to decrease while months with above-normal precipitation are expected to increase. In addition, models suggest modest but significant increases in annual-mean runoff and small changes in annual-mean soil moisture. The (NOAA) Climate Explorer provides observed and projected temperature, precipitation, and related climate variables for every county in the contiguous United States. **Table [X]** summarizes data derived from these resources for the project area.

Table 2: Pennsylvania Climate Projections

Source	Data or Statements from Resource
Pennsylvania Climate Change Impacts Assessment (2016)	Pennsylvania's current warming and wetting trends are expected to continue at an accelerated rate. This report adopts the Representative Concentration Pathway 8.5 (RCP 8.5), one of the four greenhouse gas concentration trajectories adopted by the Intergovernmental Panel on Climate Change (IPCC) for its fifth Assessment Report (AR5) in 2014. Under RCP 8.5, it is projected that by the middle of the 21st century, Pennsylvania will be about 5.4°F warmer than it was at the end of the 20th century. The corresponding annual precipitation increase is expected to be 8%, with a winter increase of 14%. The likelihood for meteorological drought is expected to decrease while months with above-normal precipitation are expected to increase.
NOAA Climate Explorer (2016)	The number of days per year when locations receive more than 1 inch of precipitation is an indicator of how often heavy precipitation events occur. This measurement may also be used as an indicator of flood risk. Comparing values at a single location over time can indicate a trend of increasing or decreasing flood risk. Under RCP 8.5, models project an increase of [x]additional days with higher than 1 inch of rainfall between 2017 and 2070.

	▯ The total number of days per year with maximum temperature above 95°F is an indicator of how often very hot conditions occur. These higher temperature days may also impact infrastructure and construction activities. Under RCP 8.5, models predict an increase of approximately [x] days with temperatures above 95 degrees between 2017 and 2070.

Climate change vulnerability or risk assessments conventionally focus on the direct impacts of climate change on human or natural systems (such as transportation infrastructure). The vulnerability of the system depends on the climate change to which the system is exposed, the sensitivity of the system to the exposure, and the adaptation of the system to ameliorate harms or exploit opportunities. The costs (and possible benefits) of climate change to Pennsylvania's transportation infrastructure have not been systematically investigated and are thus highly uncertain. However, the presence of certain climate stressors may result in impacts to infrastructure as well as changes in operations/maintenance of the facility. Based on the changes in temperatures and precipitation predicted in the state of Pennsylvania, applicable examples of these include:

- Maximum temperature increases resulting in premature deterioration of infrastructure, buckling/rutting, and thermal expansion of bridge joints.
- Greater changes in precipitation levels causing changes in soil moisture levels and accelerated deterioration, road embankment upheaval, and flooding resulting in increased road closures.
- Increased winter precipitation can result in increased deterioration of infrastructure due to snow/ice removal and salting use.
- Increased intensity of storms can result in damage to culverts and roads near flood zones, increased scour potential for bridges, high wind events cause more infrastructure vulnerability.

The "Build" alternatives for [project] will generally follow the existing alignment. The proposed reconstruction and expanded footprint could impact the following sectors: [list impacted sectors described in PA climate reports]. Detailed impact analyses of each of the "Build" alternatives can be found in the respective resource impact discussion of this NEPA document. PennDOT's recently completed Extreme Weather Vulnerability Study focuses on an evaluation of historic flooding vulnerabilities, development of a framework for addressing climate change impacts, and an initial assessment of risks and priorities related to the identified vulnerabilities. The study does not identify the project study area as a high risk historic flooding vulnerability. [Indicate forecast scenario flooding assessments for county, if applicable].

Mitigation

The [project] is not expected to negatively impact GHG emissions, and as such, specific mitigation measures are not warranted. In addition, national fuel economy standards including the GHG emission standards established by USDOT and EPA are expected to provide further reductions in transportation sector emissions.

There are a number of national research projects underway that are aiming to identify how climate stressors may impact current transportation design, construction and maintenance activities. PennDOT has initiated a multi-phase effort aimed to better anticipate the consequences and impacts of extreme weather events and to identify funding priorities and strategies to improve transportation system resiliency. The [project] will include significant improvements to the stormwater infrastructure as part of the roadway reconstruction. These changes are expected to improve the resiliency of the roadway and bridge infrastructure to storm

events. Additional improvements to ensure infrastructure resiliency may also be addressed in post-NEPA design activities.

APPENDIX 3

Acronyms and Glossary of Common Terms

ACRONYMS

AADT - Average Annual Daily Traffic

CAA - Clean Air Act

CAAA - Clean Air Act Amendments

CAL3QHC - EPA's mobile-source pollutant dispersion model

CAL3Interface - FHWA Windows-based Interface to the CAL3QHC computer model

CEE - Categorical Exclusion Evaluation

CFR - Code of Federal Regulations

CMAQ - Congestion Mitigation and Air Quality Improvement Program

CO - Carbon Monoxide

PaDEP - Pennsylvania Department of Environmental Protection

EA - Environmental Assessment

EIS - Environmental Impact Statement

ERLT – Emission Rate Lookup Table

EMFAC – Emissions Factors Model, used in California

EPA - Environmental Protection Agency

EPDS - Environmental Policy Development Section

ETC - Estimated time of completion; the opening year of an improved transportation facility

FHWA - Federal Highway Administration

FTA - Federal Transit Administration

GHG – Greenhouse Gas

HCS - Highway Capacity Software

HEPE –FHWA Office of Project Development and Environmental Review

HEPN – FHWA Office of Natural and Human Environment

ICE – Infrastructure Carbon Estimator

ICG - Interagency Consultation Group

I/M - Inspection / Maintenance Program

ISTEA - Intermodal Surface Transportation Efficiency Act of 1991

LOS – Level-of-Service, a measure of traffic congestion mg/m^3 –

Milligram per cubic meter

MOBILE - EPA's previous mobile-source emissions model

MOVES - Motor Vehicle Emission Simulator; EPA's pollutant emissions model

MOVES2014a – EPA's latest version of the MOVES model

MPH – Miles per hour

MPO - Metropolitan Planning Organization

MSATs - Mobile Source Air Toxics

NAAQS - National Ambient Air Quality Standards

NEPA - National Environmental Policy Act of 1969

NO_x – Nitrogen oxides

NO_2 – Nitrogen dioxide

PaDEP – Pennsylvania Department of Environmental Protection

PennDOT - Pennsylvania Department of Transportation

PLAN – Long Range Transportation Plan

PM - Particulate matter

PM_{10} - "Coarse" particulate matter 10 microns or less in size

$PM_{2.5}$ - "Fine" particulate matter 2.5 microns or less in size

POM – Polycyclic organic matter

PPM - Parts per million

RPO – Regional Planning Organization

SAFETEA-LU - Sate, Accountable, Flexible, Efficient Transportation Equity Act: A legacy for Users

SIP - State Implementation Plan

SO_2 – Sulfur dioxide

TIP - Transportation Improvement Program

TEA-21 - Transportation Equity Act of the 21st Century ug/m^3

- Micrograms per cubic meter

USC – United States Code

USDOT - United States Department of Transportation

VMT - Vehicle miles traveled

VOC – volatile organic compound

GLOSSARY OF COMMON TERMS

Act 120 - A Pennsylvania Legislative Act passed on May 6, 1970 which in part created PennDOT and granted it certain powers, duties and responsibilities. The act also orders PennDOT to coordinate transportation projects with other public agencies and authorities. **Section 2002** of the act states that PennDOT must issue specific findings whenever lands from recreation areas, wildlife and waterfowl refuges; historic sites, state forestland, state wilderness areas, state game lands, and public parks are needed for transportation purposes.

Adaptation – Actions to avoid, withstand, or take advantage of current and projected climate changes and impacts. Adaptation decreases a system's vulnerability.

Air Quality Sensitive Receptors – Locations such as day care centers, schools, retirement homes, hospitals, or residences close to major roadways or stationary sources, which could be impacted by air pollutants.

Avoidance Techniques – Measures incorporated with a transportation project to reduce the severity of air quality impacts. Possible measures include: congestion management systems (CMS), transportation systems management (TSM), and travel demand management (TDM).

CAL3interface Dispersion Model - FHWA-developed interface to EPA's CAL3QHC computer model. CAL3interface extends the functionality of the EPA models by providing interactive graphical forms for data entry; quality control checks on input data; increased capacity for receptor and link analyses; and a worst-case screening tool to predict CO dispersion from roadway sources to adjacent receptors.

CAL3QHC - CAL3QHC is an EPA-approved mobile source dispersion model used to predict CO (and other inert pollutants) concentrations at sensitive locations adjacent to roadways and roadway intersections. The CAL3QHC model is an effective tool for predicting emissions due to motor vehicles operating under free-flow conditions, as well as from idling vehicles under stop-and-go conditions (at signalized intersections).

Categorical Exclusion Evaluation (CEE) – A classification given to federally-aided or 100% state-funded projects or actions that do not have a significant effect on the environment either individually or cumulatively. Once a CEE is approved for a project, environmental clearance requirements of NEPA and Pennsylvania Act 120 have been satisfied.

Clean Air Act and Clean Air Act Amendments (CAA and CAAA) – The Clean Air Act of 1970 (CAA) established National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. It also required states to prepare and implement control plans to demonstrate that they could achieve the NAAQS. In 1990, the CAA was amended again (Clean Air Act Amendments – CAAA) to include strategies to achieve and maintain the criteria air pollutant NAAQS, to reduce air pollutant and pollutant precursor emissions from mobile sources, and to provide enforcement sanctions for not achieving and maintaining the NAAQS.

Congestion Management Systems – A management system required under ISTEA defined as a systematic process that provides information on transportation system performance to decision-makers for selecting and implementing cost-effective strategies to manage new and existing facilities so that traffic congestion is alleviated and the mobility of persons and goods enhanced.

Cumulative Effects – The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.

Environmental Assessment (EA) – A document prepared for federally-aided or 100% state-funded transportation projects that are not eligible for a categorical exclusion evaluation (CEE) and do not appear

to be of significant magnitude to require and Environmental Impact Statement (EIS). An EA provides the analysis and documentation to determine if an EIS or finding of no significant impact (FONSI) should be prepared.

Environmental Impact Statement (EIS) – A detailed written report that provides full and fair discussion of significant environmental impacts and informs decision-makers and the public of reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment.

Environmental Policy Development Section (EPD) – A major administrative unit of PennDOT responsible for managing Department environmental programs, including developing and providing environmental policy procedures and technical guidance to other Department offices.

Exempt Project – Projects that are considered insignificant from an air quality perspective, as per 40 CFR 93.126. These project types (listed in Table 2.1) are exempt from (not subject to) all conformity requirements as per US EPA Final Conformity Rule.

Finding of No Significant Impact (FONSI) – A document presenting the reasons why an action will not have a significant effect on the human environment and for which an environmental impact statement therefore will not be prepared. It shall include the environmental assessment or a summary of it and shall note any other environmental documents related to it. If the assessment is included, the finding need not repeat any of the discussion in the assessment but may incorporate it by reference.

Hot-Spot Analysis – An estimation of likely future localized CO (and other) pollutant concentrations and a comparison of those concentrations to the National Ambient Air Quality Standards (NAAQS). Total pollutant concentrations (project-related + background) must be estimated and analyzed at appropriate worst-case receptor locations in an area substantially affected by the project. Hot-spot analyses typically consider air quality impacts on a scale much smaller than the entire nonattainment or maintenance area, such as congested roadways or signalized intersections where roadway improvements are planned.

Impacts – Positive or negative effects upon the natural or human environment resulting from transportation projects.

Level-of-Service (LOS) – A measure employed to describe roadway operational conditions in terms of speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of LOS are defined for transportation facilities, designated as LOS A (best operating conditions) through LOS F (worst operating conditions).

Maintenance Area – Any geographical region of the United States previously designated as nonattainment (for a specific pollutant) pursuant to the CAA Amendments of 1990, and subsequently re-designated to attainment at a later date. These areas are required to develop a maintenance plan under Section 175A of the CAA, as amended. Areas in maintenance status require regional and project-level conformity determinations (for the specified pollutants) until the area formally achieves attainment-status, as designated by the EPA.

Metropolitan Planning organizations (MPOs) – Metropolitan Planning Organizations (MPOs) are transportation planning policy-making organizations made up of representatives from local government and transportation authorities. MPOs are an integral part of the transportation planning process, including regional conformity determination for pollutants of concern and review and certification of the TIP.

Mitigation – Actions to reduce greenhouse gas emissions.

MOVES - MOVES is the EPA-approved mobile source emission model used to predict CO, PM, and other pollutant emission rates in terms of grams per mile under various operating parameters and atmospheric conditions.

Mobile Source Air Toxics (MSATs) – The Clean Air Act identified 188 air toxics referred to as hazardous air pollutants. The EPA has assessed this list of toxics and identified a group of 21 as mobile source air toxics (MSATs), which are described in an EPA final rule, *Control of Emissions of Hazardous Air Pollutants from Mobile Sources* (66 CFR 17235). The EPA also identified a subset of this list that are now considered the six priority MSATs. These are benzene, formaldehyde, acetaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, and 1,3-butadiene. While these MSATs are considered the priority transportation toxics, the EPA has indicated that the lists are subject to change in future rules.

National Ambient Air Quality Standards (NAAQS) – The US EPA's Office of Air Quality Planning Standards has established National Ambient Air Quality Standards (NAAQS) for seven pollutants, referred to as the criteria air pollutants. The pollutants are ozone, nitrogen dioxide, particulate matter ($PM_{2.5}$ and PM_{10}), sulfur oxides, carbon monoxide, and lead. The standards are provided in Section 1.4.2.2 of this guidance.

National Environmental Policy Act (NEPA) - The National Environmental Policy Act of 1969 (NEPA) is the basic national charter for the protection of the environment. It establishes environmental policy, provides an interdisciplinary framework to prevent undue environmental damage, and contains procedures to ensure that decision-makers consider environmental factors. The NEPA process evaluates alternative courses of action based on the dual purpose of environmental protection and transportation improvement goals. The range of alternatives analyzed encompasses a variety of factors including social, economic, and environmental effects.

Nonattainment Area – Any geographic region of the United States which has been designated as nonattainment under Section 107 of the CAAA for any pollutant for which a national ambient air quality standard (NAAQS) exists. These areas must take specific emission reduction measures to reach compliance with NAAQS.

Non-exempt Project – A project that does not appear in the US EPA Final Conformity Rule (and in Table 2.1 of this guidance), which has the potential to increase or decrease or contribute to save in mobile source emissions. These projects must be included in the regional ozone conformity analysis.

Persistence Factor – A factor used to derive eight-hour pollutant concentrations from predicted worstcase, one-hour levels. The use of a persistence factor accounts for a combination of the variability in both traffic and meteorological conditions that typically occur over the required eight-hour averaging periods. EPA recommends a default persistence factor of 0.7 to convert one-hour CO concentrations to eight-hour levels.
Project Change – A significant change in the project during the Preliminary Design, Final Design, or Construction Phases that is different from initial planning assumptions, design concept, and/or design scope delineated during either an LRP or TIP conformity determination.

Project Screening – A process applied to all projects, regardless of the geographic location, that will identify the potential for negative local and regional air quality impacts. This process will utilize conformity related definitions to segregate projects that impact air quality and determine the level of detail for further air quality analysis requirements.

Qualitative Analysis – General air quality analysis for projects that are determined to be insignificant from an air quality perspective and will obviously not impact local air quality. These analyses typically provide a general discussion as to why no air quality impacts are anticipated.

Quantitative Analysis – Detailed air quality analysis where multiple factors are evaluated and compared by the use of measurable data and results. Typical quantitative air quality analyses rely on the air quality emission and dispersion models to predict total pollutant concentrations at specific locations. These concentrations are typically compared to the NAAQS to ensure the project would not lead to project-level air quality impacts.

Regional Conformity - Regional conformity analyses are conducted to ensure that total emissions associated with transportation plans and programs are within regional emission budgets identified in State SIPs. Conformity is a way to ensure that federal funding and approval are only given to those transportation activities that are consistent with air quality goals for a given region (as identified in the SIP).

Regionally Significant Project – The EPA Final Conformity Rule defines a regionally significant transportation project (other than an exempt project) as a project that is on a facility which serves regional transportation needs (such as access to and from the area outside of a region, major activity centers in the region, major planned developments such as retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network, *including at a minimum all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel.* The Pennsylvania Conformity SIP further defines the determination of a regionally specific project to be a topic of interagency consultation and allows the definition of a regionally significant project to be a topic of interagency consultation and allows the definition of regionally significant to be expanded through this process.

Resiliency – Capacity of a system (e.g., transportation infrastructure) to absorb disturbance and still retain its basic function and structure.

State Implementation Plan (SIP) – SIPs are agreements between the US EPA and state Air Quality Agencies (e.g., PaDEP), developed to demonstrate how the state will comply with the Clean Air Act. It ensures that emissions associated with transportation activities do not worsen air quality or interfere with the attainment of EPA standards for pollutants of concern.

Transportation Control Measure (TCM) – Any measure that is specifically identifies and committed to in the applicable implementation plan that is either one of the types listed in Section 108 of the CAAA, or any other measure for the purpose of reducing emissions or concentrations of air pollutants form transportation sources by reducing vehicle use, speed, or changing traffic flow or congested conditions. Notwithstanding the above, vehicle technology-based, fuel-based, and maintenance-based measures which control the emissions from vehicles under fixed traffic conditions are not TCMs.

Transportation Improvement Program (TIP) – The Transportation Improvement Program is a prioritized, multi-year program for the implementation of regional transportation improvement projects. It serves as a management tool to ensure the most effective use of funding for transportation improvements.

Vulnerability Assessment – How climate change and extreme weather may affect infrastructure based on its structural strength and integrity.

APPENDIX 4

Document Reference Guide

HYPERLINKS & ADDITIONAL INFORMATION

REGULATIONS

1. Clean Air Act Legislation https://www.epa.gov/clean-air-act-overview

2. Transportation Conformity Regulations https://www.epa.gov/state-and-local-transportation/transportation-conformity

3. EPA Project Level Conformity and Hot Spot Analyses https://www.epa.gov/state-and-local-transportation/project-level-training-quantitative-pm-hot-spotanalyses

4. EPA's Guidelines on Air Quality Models https://www.epa.gov/scram/air-quality-models

5. Final Rule for Control of Hazardous Air Pollutants from Mobile Sources https://www.epa.gov/mobile-source-pollution/final-rule-control-hazardous-air-pollutants-mobile-sources

6. National Ambient Air Quality Standards http://www.fhwa.dot.gov/legsregs/legislat.html

7. FHWA's Carbon Monoxide Categorical Hot-Spot Finding http://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/cmcf/

8. FHWA Transportation Planning Requirements and Their Relationship to NEPA Approvals http://www.fhwa.dot.gov/planning/tpr_and_nepa/supplementmemo.cfm

GUIDANCE

9. National Environmental Policy Act – Guidance & Information https://www.epa.gov/nepa/national-environmental-policy-act-policies-and-guidance

10. Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas (EPA-420-B-15-084) https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses

11. Guidelines for Modeling Carbon Monoxide from Roadway Intersections (EPA-454-R-92-005) https://www.epa.gov/scram/air-quality-models

12. Using MOVES in Project Level Carbon Monoxide Analyses (EPA-420-B-10-041) https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1009HZG.TXT

13. Using MOVES2014 in Project-Level Carbon Monoxide Analyses (EPA-420-B-15-028) http://www3.epa.gov/otaq/stateresources/transconf/documents/420b15028.pdf

14. FHWA Air Quality Information http://www.fhwa.dot.gov/environment/air_quality/

15. Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA (HEPN-10) http://www.fhwa.dot.gov/environment/air_quality/air_toxics/

16. Exempt Projects or Projects with No Meaningful Potential MSAT Effects (Appendix A – Prototype Language) http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/aqintguidapa.cfm

17. Projects with Low Potential MSAT Effects (**Appendix B** – Prototype Language) http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/aqintguidapb.cfm

18. Unavailable for a project-specific assessment of MSAT impacts (**Appendix C** – Prototype Language) http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/aqintguidapc.cfm

19. FHWA Technical Advisory T 6640.8A, Guidance for Preparing and Processing Environmental and Section 4(f) Documents http://environment.fhwa.dot.gov/projdev/impTA6640.asp

20. A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives http://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/msatemissions.pdf

21. Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process (Federal Highway Administration (FHWA), 2003) https://www.environment.fhwa.dot.gov/guidebook/qaimpact.asp

MODELING TOOL REFERENCES

22. EPA MOVES– Vehicle Emission Modeling Software https://www.epa.gov/moves

23. EPA CAL3QHC – Highway Dispersion Modeling Software https://www.epa.gov/scram/air-quality-dispersion-modeling-alternative-models

24. AERMOD Software Information https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models

25. FHWA Office of Planning, Environment, & Realty Models and Methodologies http://www.fhwa.dot.gov/environment/air_quality/methodologies/

26. FHWA Resource Center – Air Quality Solutions/Best Practices https://www.fhwa.dot.gov/resourcecenter/teams/environment/solutions.cfm

27. NCHRP 25-38: Input Guidelines for MOVES http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3191

28. NCHRP 25-48: Combined Interface for Project Level Air Quality Analysis (Research in Progress) http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3674

29. Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors, EPA https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors-stationary-sources

30. NONROAD Model (nonroad engines, equipment, and vehicles) EPA http://www3.epa.gov/otaq/nonrdmdl.htm

31. FHWA ICE Tool https://highways.dot.gov/safety/intersection-safety/ice

RESOURCES FOR RESEARCH AND BEST PRACTICES

32. EPA Greenbook (Nonattainment designations for all criteria pollutants) https://www.epa.gov/green-book

33. National Ambient Air Quality Standards https://www.epa.gov/criteria-air-pollutants/naaqs-table

34. Transportation Conformity (FWHA) http://www.fhwa.dot.gov/environment/air_quality/conformity/index.cfm

35. Transportation Conformity (EPA) https://www.epa.gov/state-and-local-transportation/transportation-conformity

36. FHWA Air Quality Information http://www.fhwa.dot.gov/environment/air_quality/

37. FHWA Highway Legislation and Regulations http://www.fhwa.dot.gov/resources/legsregs/

38. FHWA Resource Center – Air Quality Team Members / Contact Information https://www.fhwa.dot.gov/resourcecenter/teams/environment/

39. A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives
    http://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/msatemissions.cfm

40. PaDEP Ambient Air Quality Report & Information http://www.dep.state.pa.us/dep/deputate/airwaste/aq/aqm/aqreport.htm

41. PaDEP information on attainment status by pollutant in Pennsylvania https://www.pa.gov/agencies/dep/programs-and-services/air/bureau-of-air-quality/business-topics/regulations-and-clean-air-plans/attainment-status.html

42. EPA Air Data Monitoring Website http://www3.epa.gov/airdata/

43. Project-Level Training for Quantitative PM Hot-Spot Analyses http://www3.epa.gov/otaq/stateresources/transconf/training3day.htm

44. AASHTO Practitioner's Handbook: 12 Assessing Indirect Effects and Cumulative Impacts Under NEPA
    https://environment.transportation.org/resources/practitioners-handbooks/assessing-indirect-effects-and-cumulative-impacts-under-nepa/

45. NCHRP Report 466: Desk Reference For Estimating the Indirect Effects of Proposed Transportation Projects http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_466.pdf

46. Revised Guidelines for the Control of Carbon Monoxide (CO) Levels in Tunnels https://www.environment.fhwa.dot.gov/guidebook/vol1/doc1q.pdf

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48. NCHRP 25-25 Task 70: Assessment of Quantitative Mobile Source Air Toxics in Environmental Documents
    http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(70)_FR.pdf

49. NCHRP 25-25 Task78 Template Programmatic Agreement for Carbon Monoxide http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3311

50. NCHRP 25-25 Task 89 Establishing Representative Background Concentrations for Quantitative

Hot-Spot Analyses for Particulate Matter http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(89)_FR.pdf

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