Aviation Emissions and Air Quality Handbook Version 4

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LIST OF CHANGES

Section 4 has been revised to reflect the screening procedure for attainment areas and to streamline the written descriptions.

Section 8 has been revised to provide greater clarity on the details of determining if a general conformity evaluation or determination are required.

Appendices A though F have been removed.

EXECUTIVE SUMMARY

The long-standing relationship between aviation and air quality continues to endure as the aviation industry seeks to (i) develop, expand, and/or improve its facilities, equipment, and procedures; (ii) repair/replace aging infrastructure; and/or (iii) accommodate the forecasted growth in air traffic (including new entrants such as unmanned aircraft systems and/or commercial space transportation) while implementing sustainable practices. Meanwhile, air quality regulatory agencies continually strive to safeguard human health and the natural environment from the effects of air pollution – including the air emissions associated with aviation.

In support of this relationship, this *Aviation Emissions and Air Quality Handbook* (the *Handbook*) has been published by the Federal Aviation Administration (FAA) as a tool and resource to assist in the planning and completion of *air quality assessments*[1] conducted for aviation-related Federal Actions. More specifically, the purpose of this *Handbook* is essentially three-fold:

- To provide guidance, procedures, and methodologies appropriate for use in carrying out air quality assessments prepared in association with FAA Federal Actions;
- To help ensure that these air quality assessments meet the requirements of the National Environmental Policy Act (NEPA), the federal Clean Air Act (CAA), and other applicable laws and regulations; and
- To provide a process for users to determine when an air quality assessment is considered necessary, the type of analysis that is appropriate, and the level of effort that is warranted.

Notably, this *Handbook* was prepared for use by the FAA, its lines of business, and offices as well as project applicants and/or their representatives that are involved in the assessment of air quality impacts associated with aviation-related Federal Actions. However, it is intended that other stakeholders will likewise find it useful including federal/state/local/tribal governmental agencies and others with an interest in ensuring that the nation's airports are continually modernized while safeguarding air quality. By necessity, the *Handbook* is also designed to be used by both seasoned practitioners and newcomers to the aviation air quality assessment process.

The earliest version of the *Handbook* was published in 1982 by the FAA and the U.S. Air Force, was fully revised in 1997, subsequently updated by *Addendum* in 2004, and significantly revised in 2015. While some of the materials contained in these earlier versions are reused, it is intended that this version of the *Handbook* replace and supersede these documents. As of the date of publication of this version of the *Handbook*, previous versions are cancelled. Moreover, as a guidance document, the *Handbook* is not intended to replace laws, regulations, or other requirements pertaining to air quality. This *Handbook* is a guidance document and should not be cited as the source for legal requirements (e.g., laws, regulations). In the case of any discrepancies or differences found between the legal requirements and the *Handbook*, users should defer to the specific language and requirements contained in the legal requirements. This document does not have the force and effect of law and is not meant to bind the public or impose any new requirements in any way, and the document is intended only to provide information to the public regarding existing requirements under the law or agency policies.

[1] For the purpose of this *Handbook* an air quality assessment encompasses both the qualitative and the technical aspects of assessing air quality such as performing air emissions inventories, dispersion modeling, etc., as well as determining whether compliance with the CAA, NEPA, and if applicable, other state and local air regulations is achieved.

Finally, the contents of the *Handbook* are organized around a framework of topics and sections that build upon one another in a progressive fashion. However, for those that wish to focus on particular topics of interest, each section is designed to be self-supporting and comprehensive.

For general questions regarding this *Handbook* contact the Emissions Division located in the FAA Office of Environment and Energy (AEE).

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1. Introduction and Background

This section discusses the purposes for which this *Aviation Emissions and Air Quality Handbook* (the *Handbook*) was prepared, the intended audience, its primary objectives, and its contents.

1.1. Purpose of This Handbook

This *Handbook* has been published by the Federal Aviation Administration (FAA) as explanatory guidance, and is a tool and resource designed to assist the FAA and stakeholders in the planning, organization, and completion of air quality assessments for aviation-related projects and/or actions that require FAA funding, licensing, permitting, or approval (herein referred to as Federal Actions). In this document, the term Federal Action will refer to FAA performing 'major federal actions' as described in FAA Order 1050.1 (National Environmental Policy Act), as well as a 'federal action' as described in 40 CFR 93.152 (Clean Air Act, General Conformity Requirements). This reflects the experience that it is rare that an action would satisfy one but not both of these definitions. If an action meets only one of these definitions, the practitioner will need to carefully evaluate the appropriate regulatory requirements. However, the *Handbook* does not directly address this situation.

Following the guidance in this *Handbook* will help to ensure that air quality assessments for these Federal Actions are comprehensive, consistent, and appropriate for use in the disclosure and decision-making processes, as well as assisting stakeholders in meeting legal requirements.

The effects on air quality from aviation and aviation-related developments and operations have long been an important subject matter. On the one hand, the aviation industry performs vital civic and economic functions by serving scheduled and unscheduled operations of air carriers which enable the transportation of passengers and cargo safely and efficiently across the country and throughout the world. For over 100 years, airports (including general aviation [GA] airports) have remained among the enabling resources for progress and prosperity within the communities they serve. On the other hand, air pollutants associated with aviation emission sources have been an inevitable consequence of these activities and can have impacts on local and regional air quality as well as effects on progress toward global climate change goals.

This long-term connection between aviation and air quality has been growing in importance as the aviation industry seeks to (i) develop, expand, and/or improve their facilities, equipment, and procedures; (ii) repair/replace aging infrastructure; and/or (iii) accommodate the forecasted growth in air traffic (including new entrants such as unmanned aircraft systems and/or commercial space transportation) while implementing sustainable practices. Meanwhile, air quality regulatory agencies continually strive to safeguard human health and the natural environment from the effects of air pollution – including the air emissions associated with aviation.

Historically, the junction where FAA evaluates air quality impacts from Federal Actions is during the environmental review that is done to comply with the National Environmental Policy Act (NEPA) (discussed in greater detail in **Section 2***, Regulatory Framework*). In that environmental review, air quality impacts and compliance with the federal Clean Air Act (CAA) are often discussed. The CAA mandates that the air quality impacts associated with Federal Actions do not cause, contribute to, or worsen violations of relevant air quality standards, criteria and/or

thresholds, nor may they delay timely attainment of these standards.[2] NEPA requires agencies to consider the environmental impacts of, and alternatives to, proposed Federal Actions before committing resources to their implementation. NEPA also requires agencies to inform the public that the agency has considered such impacts in the decision-making process.[3]

The FAA typically fulfills the requirements of NEPA and the CAA through the analyses and documentation included in NEPA reviews. In many cases, the air quality analysis is an integral component of these assessments and is relied upon by the FAA to support decision-making. Therefore, in support of the documentation of these air quality assessments, the purpose of this *Handbook* is essentially three-fold:

- To provide a process for users to determine when an air quality assessment is considered necessary, the type of analysis that is appropriate, and the level of effort that is warranted;
- To provide guidance, procedures, and methodologies appropriate for use in carrying out air quality assessments prepared in association with FAA Federal Actions;
- To help ensure that these air quality assessments adequately disclose air quality impacts in accordance with NEPA and that the project complies with the applicable requirements of the General Conformity regulations and National Ambient Air Quality Standards (NAAQS) of the CAA.

1.2. Use of the *Handbook*

This *Handbook* was prepared for use by the FAA, applicants and/or their representatives, and other stakeholders who are involved in the assessment of air quality impacts associated with FAA Federal Actions.

Notably, the *Handbook* is designed to be used by both seasoned practitioners and newcomers to the air quality assessment process. As a result, it is necessarily broad and extensive and should not be expected to provide the level of detail necessary for every type of project, action, or circumstance. Rather, it is designed to provide the user with an overview of the overall approaches and the assessment methods that may be used for conducting air quality analyses.

The earliest version of the *Handbook* was published in 1982 by the FAA and the U.S. Air Force. This document was fully updated in 1997 by the FAA and subsequently updated by *Addendum* in 2004, and was revised again in 2015. While some of the materials contained in these earlier versions are reused, it is intended that this version of the *Handbook* replace and supersede these prior documents. As of the publication of this version of the *Handbook*, previous versions are cancelled. However, as a technical manual or guidance document, the *Handbook* does not replace laws, regulations, or other requirements pertaining to air quality. In the case of any discrepancies or differences found between the *Handbook* and the statutes and regulations on which the *Handbook* is based, readers should defer to the specific language and requirements contained in the legally controlling documents. This document does not have the force and effect of law and is not meant to bind the public in any way, and the document is intended only to provide information to its users and the public regarding existing requirements under the law or agency policies.

[2] See 40 CFR 93.153(g).

[3] 40 CFR 1500.1(a).

1.3. Contents of the *Handbook*

The contents of the *Handbook* are organized around a framework of topics and sections that build upon one another in a progressive fashion. However, for those that wish to focus on particular topics of interest, each section is designed to be self-supporting and comprehensive. The following provides a summary description of each section:

- ***Section 1: Introduction and Background*** – Provides basic and introductory information that helps the user to understand why this *Handbook* was created, its intended audience, and its overall objectives.
- ***Section 2: Legal Framework*** – Identifies and summarizes pertinent legal requirements (e.g., statutes, regulations, etc.) that stipulate or drive the need for an air quality assessment.
- ***Section 3: Sources and Types of Air Emissions*** – Describes the most common sources of air emissions associated with aviation, including the types of emissions that typically characterize each source.
- ***Section 4: Air Quality Assessment Process*** – Discusses and delineates the overall approach to assessing air quality impacts associated with FAA Federal Actions. Flowcharts are provided to help guide the process of performing the assessment.
- ***Section 5: Air Quality Assessment Models*** – Describes the various assessment models that are available and recommended or required to conduct aviation-related air quality assessments. Typical data requirements and documentation of the results are also discussed.
- ***Section 6: Preparing an Emissions Inventory*** – Describes the recommended methods for preparing aviation-related emission inventories for the EPA "criteria" pollutants, hazardous air pollutants (HAPs), and greenhouse gases (GHGs) and for reporting the results of these analyses.
- ***Section 7: Conducting Dispersion Modeling*** – Describes the recommended methods for conducting atmospheric dispersion modeling around airports and airport roadways and for reporting the results of these analyses.
- ***Section 8: Conformity*** – Discusses the conformity regulations of the federal CAA and how/when they apply to FAA Federal Actions requiring conformity.
- ***Section 9: Coordination Best Practices*** – Discusses the objectives, benefits, and methods of conducting agency coordination in support of aviation-related air quality assessment processes.

To aid in the comprehension and use of this material, a ***Glossary***, lists of ***References***, and ***Acronyms*** and ***Abbreviations*** are provided at the end of the *Handbook*.

2. Regulatory Framework

With a focus on aviation-related Federal Actions, this section identifies and summarizes pertinent legal authorities (e.g., statutes and regulations) that drive the need for and contents of an air quality assessment. Note that the term "Federal Action" is used as a general term in this document to describe actions that may be subject to environmental review. This document is premised on the term Federal Action representing actions that meet both the criteria for a "major federal action" under NEPA (as defined in 40 CFR 1508.1(q)) and a "federal action" under the CAA (as defined in 40 CFR 93.152). It is important to recognize that although each of these terms has a specific definition under the associated regulations, in practice almost all actions that meet one of these definitions will meet the other definition. FAA is using "Federal Action" generally in this document to cover actions that fall within both terms. However, there are instances where it is important to look specifically at either the NEPA or the CAA requirements and in these instances this Handbook uses the term ("major federal action" or "federal action") specific to the applicable law and regulations.

2.1. National Environmental Policy Act

Signed into law in 1970, the National Environmental Policy Act (NEPA),[4] and its amendments (enacted in 1975 and 1982),[5] established a broad national policy to protect the quality of the human environment and provided for the establishment of a Council on Environmental Quality (CEQ). The act provides policies and goals to ensure that environmental considerations are given careful attention and appropriate weight in all decisions of the federal government. The NEPA environmental review process discloses these impacts on the human environment including, but not limited to, impacts to the "natural environment," air quality, biological resources, water resources, noise, induced socioeconomic impacts, and land uses that result from major federal actions. It should reflect a thorough review of all relevant environmental factors, utilizing a systematic, interdisciplinary approach. The Term "major federal action" refers to activities or decisions that are subject to Federal control and responsibility as provided in 40 CFR 1508.1 (and thus subject to NEPA review). These actions include grants, loans, contracts, leases, construction, research, rulemaking and regulatory actions, certifications, licensing, and permitting.

In 1977, CEQ was charged with issuing regulations to federal agencies for the implementation of the procedural provisions of NEPA which were subsequently issued in 1978.[6] The CEQ regulations require federal agencies to evaluate and disclose the potential environmental effects of their actions prior to their implementation.[7] Importantly, agencies must also notify and involve the public in parts of the environmental review process for a major federal action expected to cause a significant environmental impact. The regulations emphasize the importance of integrating the NEPA process into early project planning, and of consulting with appropriate federal, state, local, and tribal

[4] The National Environmental Policy Act of 1969, Pub. L. No. 91-190, 83 Stat. 852 (January 1, 1970).

[5] Pub. L. No. 94-52 (July 3, 1975), Pub. L. No. 94-83 (August 9, 1975), Pub. L. No. 97-258 (September 13, 1982).

[6] President Carter issued Executive Order No. 11991, Environmental Impact Statements on May 24, 1977, directing CEQ to issue implementing regulations. The CEQ Regulations are codified at 40 Code of Federal Regulations (CFR) parts 1500-1508.

[7] 40 CFR 1500.1 Purpose and policy.

agencies early in the NEPA process.[8] The NEPA regulations were most recently updated in 2022 and may continue to evolve, but air quality review is likely to always be a key component of NEPA reviews.

The CEQ regulations also describe the different levels of NEPA review:

- Categorical Exclusions (CATEXs) – Categories of actions that normally do not have a significant effect on the human environment, and therefore do not require preparation of an environmental assessment or environmental impact statement.[9] FAA has adopted NEPA implementing procedures that describe pre-established categories of actions that could potentially be categorically excluded.[10]
- Environmental Assessments (EAs) – In cases where a CATEX does not apply to a proposed major federal action, the agency may then prepare an EA, which determines whether or not a major federal action has the potential to cause significant effects on the human environment. If the agency determines that the proposed major federal action will not result in significant environmental impacts, the agency will issue a Finding of No Significant Impact (FONSI) presenting the rationale for the conclusion.[11] If the agency determines that the environmental impacts of a proposed major federal action may be significant, an Environmental Impact Statement (EIS) is prepared.[12]
- EIS – An EIS is prepared in cases where a proposed major federal action may significantly affect the human environment. The EIS is a detailed analysis prepared when impacts would be significant and mitigation measures would not reduce the impacts below significant levels. The EIS process ends with the issuance of a Record of Decision (ROD) describing the agency's decision, alternatives, and any required mitigation and monitoring plans.[13]

CEQ oversees the procedural provisions of NEPA and the administration of the NEPA process for all federal agencies. In addition, the CEQ regulations require federal agencies to adopt their own implementing procedures. The Department of Transportation (DOT) has issued department-wide procedures in the form of DOT Order 5610.1C. The FAA's implementing procedures are contained within FAA Order 1050.1, *Environmental Impacts: Policies and Procedures*[14] which establishes agency-specific procedures for the consideration of environmental impacts associated with the FAA's major federal actions. The order establishes the NEPA process for FAA actions in terms of planning, procedures, content and format, and public participation. In addition to Order 1050.1, the following orders and guidance documents are also used to assist with FAA NEPA compliance:

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8 40 CFR 1506.6 Public involvement.

9 40 CFR 1501.4 Categorical exclusions.

10 FAA Order 1050.1F, Ch 5.

11 40 CFR 1501.5 and 1501.6.

12 40 CFR 1501.3(a)(3); 40 CFR Part 1502.

13 40 CFR Parts 1502 and 1505.

14 See generally FAA's Orders and Notices, available at https://www.faa.gov/regulations_policies/orders_notices/.

- FAA Order 1050.1 Desk Reference[15] - The Desk Reference provides explanatory guidance for environmental impact analysis and is designed to complement FAA Order 1050.1.
- FAA Order 5050.4 and accompanying Environmental Desk Reference for Airport Actions - This order establishes specific procedures for processing NEPA documents for airport actions under FAA authority. It is recommended for airport personnel, sponsors, and others involved in airport actions when considering environmental impacts. The Desk Reference provides supplemental guidance for airport actions.[16]
- FAA Order JO 7400.2[17] - This order prescribes policy, criteria, guidelines, and procedures applicable to the System Operations Services, System Operations Airspace and Aeronautical Information Manual (AIM); Technical Operations ATC Spectrum Engineering Services; the Office of Airport Planning and Programming (APP); the Office of Airport Safety and Standards (AAS); Technical Operations Aviation System Standards (AVN); and the Flight Standards Service (AFS).

2.2. Clean Air Act

The Clean Air Act (42 U.S.C. § 7401 et al.)[18] (referred to hereafter as the Act or CAA) is the United States' federal law designed to prevent and control air pollution on a national level. The Act defines the various roles and responsibilities of the EPA, state, local, and tribal governments, and federal agencies in implementing the Act. The CAA was incorporated into the United States Code (U.S.C.) as Title 42, Chapter 85, "*Air Pollution Prevention and Control.*" The last major change to the Act was the *Clean Air Act Amendments of 1990*, and since then several minor changes have been made.[19] The CAA is comprised of six major "subchapters"

- *Subchapter I: Programs and Activities* (Parts A thru D) includes –
  - Part A establishes the National Ambient Air Quality Standards (NAAQS) (§ 7409); the framework for preparing State Implementation Plans (SIP) (§ 7410 and § 7424); and describes the assessment and control of hazardous air pollutants (§ 7412);
  - Part B was repealed under the 1990 Amendments of the CAA and moved *Stratospheric Ozone Protection* to its own Subchapter VI;
  - Part C contains the requirements for Prevention of Significant Deterioration (PSD) permits.; and

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15 FAA Order 1050.1F, issued July 16, 2015; https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf.

16 FAA Order 5050.4B, National Environmental Policy Act *(NEPA) Implementing Instructions for Airport Actions* issued April 28, 2006.

17 Issued 5/13/21. FAA, *Orders and Notices*, https://www.faa.gov/regulations_policies/orders_notices/.

18 Clean Air Act Amendments of 1970, Pub. L. 91-604, 84 Stat.1676. Implementation regulations are codified at 40 CFR subchapter C, parts 50-97.

19 Congressional Research Service. January 6, 2011. *Clean Air Act: A Summary of the Act and Its Major Requirements* (7-5700 RL30853). Available from the Federation of American Scientists at https://fas.org/sgp/crs/misc/RL30853.pdf.

  - Part D provides the procedures for managing nonattainment areas for the criteria pollutants and assures that emissions from any source in any state will not interfere with any portion of a state's plan to attain and maintain the NAAQS. The legal authority for the Conformity regulations is outlined in this part as well as the requirements for a New Source Review permit.

- *Subchapter II: Emission Standards for Moving Sources* (Parts A-C) – The parts of this subchapter provide authority to establish emission standards for on-road vehicles, nonroad vehicles and equipment, and aircraft—
  - Part A focuses on vehicles and equipment for new on-road models and nonroad models, including bus standards,
  - Part B focuses on the establishment of aircraft standards, enforcement of the standards and includes state standards and controls, and
  - Part C has its focus on clean fuel vehicles and the standards for heavy-duty clean-fuel.
- *Subchapter III: General Provisions* – The overall administration of the CAA is covered under this subchapter. This subchapter includes Section 309, which directs the EPA Administrator in certain circumstances to review and comment in writing on EISs prepared by other Federal agencies under NEPA;
- *Subchapter IV*: *Noise Pollution* – Retains EPA's authority to investigate and study noise and its effect, disseminate information to the public regarding noise pollution and its adverse health effects, respond to inquiries on matters related to noise, and evaluate the effectiveness of existing regulations for protecting the public health and welfare, pursuant to the Noise Control Act of 1972 and the Quiet Communities Act of 1978;
- *Subchapter IV-A:*[20] *Acid Deposition Control* – Identifies provisions for pollutant emissions in the form of acidic rain, fog, or snow that are shown to damage ecosystems, structures and impact health. This title deals mostly with emissions of sulfur dioxides and nitrogen dioxides;
- *Subchapter V: Permits* – The program for "Title V" permits issued by state and local agencies. This subchapter covers permitting for large industrial and commercial sources. It requires businesses with large emissions to address *pollutants* released into the air, measure their quantity, and have a plan to control and minimize them as well as to periodically report; and
- *Subchapter VI: Stratospheric Ozone Protection* – Pursuant to the Montreal Protocol of 1990, this subchapter identifies a timeline by which substances with stratospheric ozone depleting potential will be phased out.

[20] The *1990 Clean Air Act Amendments* added a new title IV to the CAA, relating to acid deposition control, without repealing the existing title IV, which relates to noise pollution. The U.S. Code designates the original title IV (noise pollution) as subchapter IV and the new title IV (acid deposition control) as subchapter IV-A. Search CAA titles at https://www.epa.gov/clean-air-act-overview/clean-air-act-title-iv-subchapter-acid-deposition-control.

Of the seven Subchapters listed above, the subjects discussed in subsequent sections of this *Handbook* pertain mostly to *Subchapters I, II,* and *III*.

2.2.1. National Ambient Air Quality Standards

The National Ambient Air Quality Standards (NAAQS) [21] are the core of the national regulatory program, mandated by the *CAA 1970 Amendments*, that enable the EPA to manage areas of the country experiencing potentially harmful outdoor air pollution (ambient air).[22] Under the Amendments, sections 108 and 109 of the CAA instruct the EPA to identify pollutants reasonably anticipated to endanger public health or welfare, where the emissions of such pollutants may result from diverse mobile or stationary sources.[23] Further, the EPA is tasked with establishing standards for such pollutants and assigning criteria to the standards that accurately reflect the latest scientific knowledge for indicating potential adverse impacts to public health. These standards are:

- There are six "criteria" pollutants for which national standards apply—carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb) and particulate matter (PM) that includes fine particles ($PM_{2.5}$)[24] with an aerodynamic diameter of ≤ 2.5 μm, and (PM_{10}),[25] particles with an aerodynamic diameter of ≤ 10 μm, so that $PM_{2.5}$ particles are a subset of PM_{10} particles;
- Two types of health-based standards. *Primary standards* stipulate the maximum permissible concentration of a pollutant in the ambient air above which may cause harm to public health[26], including the health of sensitive populations, such as asthmatics, children, and the elderly. All pollutants have a primary standard with an adequate margin of safety. *Secondary standards* stipulate the maximum concentration in the ambient air above which may threaten public welfare[27], including causing decreased visibility, damage to animals, crops, vegetation, and buildings. Not all pollutants have a secondary standard, and some secondary standards are identical to the primary standard.
- The EPA assigns for each criteria pollutant—
    1. *Indicator* – the name of the pollutant, *i.e.*, CO, SO_2, Pb, NO_2, PM_{10}, and $PM_{2.5}$. A few notes:

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21 40 CFR Part 50 *National Primary and Secondary Ambient Air Quality Standards*. Search the CFR online at https://www.ecfr.gov/.

22 The *CAA 1970 Amendments* give the EPA authority to create a national regulatory program to control outdoor air pollution; the NAAQS are established pursuant to section 108 (42 U.S.C. § 7408) and 109 (42 U.S.C. § 7409) of the CAA.

23 CAA section 108(a) *Air quality criteria and control techniques*, "Air pollutant list; publication and revision by Administrator; issuance of air quality criteria for air pollutants.

24 $PM_{2.5}$ are particles with an aerodynamic diameter equal to or less than 2.5 micrometers (≤ 2.5μm).

25 PM_{10} are particles with an aerodynamic diameter equal to or less than 10 micrometers and include the $PM_{2.5}$ particles.

26 40 CFR 50.2(b).

27 40 CFR 50.2(b).

- NO_2 is one of a group of gases called "oxides of nitrogen" or NOx, and while all are harmful to human health and the environment, the EPA chooses NO_2 as the indicator because it is of greatest concern;
- PM_{10} includes particles equal to or less than 10 micrometers in diameter and is the indicator that replaced the 1971 indicator for particle pollution, Total Suspended Particles (TSP); PM_{10} emissions include the subgroup of PM2.5 particles which are equal to or less than 2.5 micrometers in diameter.

2. *Standard type* – primary or secondary;
3. *Averaging time* – the timeframe over which monitored or modeled pollutant concentrations are averaged for comparison; can be short-term or long-term (*i.e.*, 1-hour, annual, etc.);
4. *Level* – maximum allowable pollutant concentration defined by the EPA as healthful in the ambient air; measured as parts per million (ppm), ppb (parts per billion), or micrograms per cubic meter ($\mu g/m^3$); levels are always measured using the unit specified for the standard;
5. *Form* – metric against which monitored/modeled data is measured to determine when the standard is attained (*i.e.*, cannot be exceeded, can be exceeded once per calendar year, etc.).

The CAA requires the EPA to periodically review the NAAQS—and the science behind them—to determine whether changes are warranted, which may be through revisions of an existing NAAQS or the establishment of a new NAAQS.[28] While the NAAQS are established on a national level, implementation occurs on state, tribal, and local levels. In addition, States and tribal governments may establish their own ambient air quality standards, provided such standards are more stringent than the national standards.[29]

The NAAQS for the six criteria pollutants are summarized in **Table 2-1**.

[28] CAA section 109(d) *National primary and secondary ambient air quality standards*, "Review and Revision of criteria and standards; independent scientific review committee; appointment; advisory functions.

[29] 40 CFR 50.2(d) *National Primary and Secondary Ambient Air Quality Standards*, "Scope."

Table 2-1. National Ambient Air Quality Standards (Environmental Protection Agency)

Criteria Pollutant		Standard Type	Averaging Time[1]	Level[2]	Form[3]
Carbon Monoxide (CO)[4]		1971 Primary	8-hour	9 ppm	Neither standard can be exceeded more than once per year.
			1-hour	35 ppm	
Lead[5]		2008 Primary and Secondary	Rolling 3-month average over 3 years	0.15 µg/m^3	Max arithmetic 3-month mean cannot exceed the standard at any time over a 3-years period.
Nitrogen Dioxide (NO_2)		2010 Primary[6a]	1-hour	100 ppb	Annual 98th percentile of daily maximum 1-hour average, averaged over 3 years, cannot exceed the standard.
		1971 Primary and Secondary[6b]	Annual	53 ppb	Calendar-year annual arithmetic mean cannot exceed the standard.
Ozone (O_3)		Primary and Secondary	8-hour	2015 0.070 ppm[7a] 2008 0.075 ppm[7b] 1997 0.08 ppm[7c]	Annual fourth-highest daily max, averaged over 3 years, cannot exceed the standard.
Particulate Matter (PM)	$PM_{2.5}$	2024 Primary[8a]	Annual	9.0 µg/m^3	Annual arithmetic mean, averaged over 3 years, cannot exceed the standard.
		1997 Secondary[8b]	Annual	15.0 µg/m^3	
		2006 Primary and Secodary[8c]	24-hour	35.0 µg/m^3	98th percentile, averaged over 3 years, cannot exceed the standard.
	PM_{10}[9]	1987 Primary and Secondary	24-hour	150 µg/m^3	Number of days on which the standard is exceeded, averaged over 3 years, cannot exceed one day per calendar year.
Sulfur Dioxide (SO_2)		2010 Primary[10a]	1-hour	75 ppb	3-year average of the annual (99th percentile) daily max cannot exceed the standard
		1971 Secondary[10b]	Rolling 3-hour average	0.5 ppm	Standard cannot be exceeded more than 1 day per calendar year.

Source: EPA, National Ambient Air Quality Standards (NAAQS), http://www.epa.gov/criteria-air-pollutants/NAAQS-table and 40 CFR part 50 *See also* the EPA NAAQS Table available at https://www.epa.gov/criteria-air-pollutants/naaqs-table; *see also* to search the Federal Register database available at https://www.govinfo.gov/app/collection/FR/

[1] "Averaging time" is the timeframe over which emission concentrations are averaged for comparison to the level and evaluated according to the form.

[2] "Level" refers to the maximum allowable average pollutant concentration across the averaging time, measured as ppm, ppb, or µg/m^3.

[3] "Form" refers to how often the pollutant level, averaged over a period of time, can be exceeded and still attain the standard.

[4] CO 1971 8-hour and 1-hour primary standard, April 30, 1971 (National Primary and Secondary Ambient Air Quality Standards, 36 Fed. Reg. 8186 (Apr. 30, 1971)).); there is no secondary standard for CO because it was revoked effective October 15, 1985 (Review of National Ambient Air Quality Standards for Carbon Monoxide; Final Rule, 50 Fed. Reg. 378484 (Sep. 13, 1985)).

[5] Pb 2008 3-month primary/secondary standards, January 12, 2009 (National Ambient Air Quality Standards for Lead, 73 Fed. Reg. 66964 (Nov. 12, 2008)).

[6a] NO_2 2010 1-hour primary standard, April 12, 2010 (Primary National Ambient Air Quality Standards for Nitrogen Dioxide, 75 Fed. Reg. 6474 (Feb. 9, 2010)); no areas designated nonattainment when the NAAQS was promulgated;

[6b] NO_2 1971 annual primary/secondary standards (National Primary and Secondary Ambient Air Quality Standards, 36 Fed. Reg. 8186 (Apr. 30, 1971).); there are no longer any areas designated nonattainment for the 1971 NO_2 standards; and all maintenance plans for the 1971 standards have expired.

[7a] O_3 2015 primary/secondary 8-hour standards, December 28, 2015 (National Ambient Air Quality Standards for Ozone, 80 Fed. Reg. 65292 (Oct. 26, 2015)).

[7b] O_3 2008 primary/secondary 8-hour standards, May 27, 2008 (National Ambient Air Quality Standards for Ozone, 73 Fed. Reg. 16436 (Mar. 27, 2008)).

[7c] O_3 1997 primary/secondary 8-hour standards, September 16, 1997 (National Ambient Air Quality Standards for Ozone, 62 Fed. Reg. 38856 (Jul. 18, 1997)).

[8a] $PM_{2.5}$ 2024 primary annual standard, February 7, 2024 (On February 7, 2024, the U.S. Environmental Protection Agency (EPA) issued a final rule to lower the primary National Ambient Air Quality Standard (NAAQS) for fine/inhalable particulate matter ($PM_{2.5}$). These standards will take effect 60 days after the final rule is published in the *Federal Register*. EPA's final rule lowers the primary annual NAAQS $PM_{2.5}$ emission standard from 12 micrograms per cubic meter (µg/m3) to 9 µg/m.)

[8b] $PM_{2.5}$ 1997 secondary annual standard, September 16, 1997 (National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38652 (Jul. 18, 1997)).

[8c] $PM_{2.5}$ 2006 primary and secondary 24-hour standards, December 18, 2006 (National Ambient Air Quality Standards for Particulate Matter, 71 Fed. Reg. 61144 (Oct. 17, 2006)).).

[9] PM_{10} primary and secondary 24-hour standards, July 31, 1987 (Revisions to the National Ambient Air Quality Standards for Particulate Matter, 52 Fed. Reg. 24634 (Jul. 1, 1987)).).

[10a] SO_2 2010 primary 1-hour standard, August 23, 2010 (Primary National Ambient Air Quality Standard for Sulfur Dioxide, 75 Fed. Reg. 35520 (Jul. 22, 2010)).).

[10b] SO2 secondary 3-hour standard, April 30, 1971 (National secondary ambient air quality standards for sulfur oxides, 36 Fed. Reg. 8187 (Apr. 30, 1971), sec. 410.5(c)).

2.2.2. Precursor Pollutants

Some criteria pollutants are emitted directly from a source, and are referred to as primary pollutants. Other pollutants are formed during photochemical reactions in the atmosphere in the presence of precursor pollutants—referred to as secondary pollutants. One of these, ozone, is formed through the photochemical reaction of precursor pollutants oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight, although some areas in colder climates experience high ozone levels in the winter, when there is very little sunlight. While there are no NAAQS for oxides of nitrogen or for VOC emissions, the EPA regulates emission rates of NOx and VOC based on their potential for ozone formation.

The secondary formation of $PM_{2.5}$ occurs through a complicated series of atmospheric chemical reactions involving precursor emissions of NOx, VOC, SO_2, and ammonia (NH_3).[30] Fine particulate matter, a mixture of solid particles and liquid droplets, is characterized by size alone and is not comprised of any specific substance.[31] Any particles suspended in the air with an aerodynamic diameter equal to or less than 2.5 micrometers (μm) are considered $PM_{2.5}$ and are regulated.

These tiny particles are harmful because they are small enough to penetrate the natural barriers in a respiratory system and can reach deep inside the lungs causing serious health problems. When the $PM_{2.5}$ precursors interact in the atmosphere, the gases combine and transform through a series of reactions ultimately changing from a vapor to a solid.

Just as there is no standard for NOx or VOC emissions involved in the formation of ozone, there is no standard for NH_3 emissions involved in the secondary formation of $PM_{2.5}$. The EPA requires an accounting of primary emissions of $PM_{2.5}$ and regulates emissions of the precursor pollutants, NOx, VOC, SO_2 and NH_3, to suggest the potential for secondary formation of $PM_{2.5}$.

2.2.3. Nonattainment Areas

Nonattainment areas are distinctly defined geographical areas of the country where the EPA finds the NAAQS are not being attained for one or more of the criteria pollutants.[32] The EPA database of attainment status designations at 40 CFR part 81 subpart C defines the geographic extent of each nonattainment area, mostly by county boundaries, but some nonattainment areas cover portions of counties and some areas of nonattainment cover portions of multiple states (some areas can be nonattainment for one or more NAAQS and attainment for others). When the EPA publishes a new or revised NAAQS, such areas will be "designated"[33] as—

1. nonattainment for any area that does not meet the form of the standards for the pollutant, given the applicable level and averaging period (or that contributes to nonattainment of the standard in a nearby area that does not meet the standards);
2. attainment for any area that meets the standard criteria for the pollutant;
3. unclassifiable for any area that cannot be designated as meeting or not meeting the standards due to the lack of available information; or
4. attainment/unclassifiable for any area that while no data is available to definitively designate the area attainment, the EPA believes that if the data were available, the area would be shown to attain the standards (sometimes the EPA lists these areas as unclassifiable/attainment, where the terms are meant to be synonymous).

[30] *Fine Particulate Matter NAAQS: State Implementation Plan Requirements*, 81 FR 58010, 58014 (August 24, 2016).

[31] This is also true of coarse particle pollution, PM_{10}. The only difference between PM_{10} and $PM_{2.5}$ is the diameter of the particles.

[32] 42 U.S.C. § 7407(d) and 7501(2). Please note that there are no nonattainment areas for emissions of precursor pollutants, instead precursor pollutants are included in the nonattainment designation of a criteria pollutant.

[33] Refer to the appendices for definitions of terms discussed in this section of the document.

After promulgating a new or revised NAAQS, the EPA will publish in the *Federal Register* a final rule to designate and, if applicable, assign classifications[34] for areas found to be nonattainment for the NAAQS. These final rules are generally effective 30 or 60 days after publication in the *Federal Register*. Under the conformity requirements, areas designated nonattainment would not be subject to Conformity requirements until one year after the effective date of designation.[35]

For some criteria pollutants, the EPA assigns a "classification" to designated nonattainment areas according to the extent of the air quality problem. For instance, for ozone nonattainment areas the EPA will, at the time of the designation, classify each nonattainment area as Marginal, Moderate, Serious, Severe, or Extreme. Areas of CO, PM_{10} or $PM_{2.5}$ nonattainment are classified as Moderate or Serious when designating nonattainment.

In addition, the final rule will provide the date by which the areas must attain the NAAQS, where the "attainment date" will depend on the classification, if one is assigned. It is the objective of states with nonattainment areas to attain the standards as expeditiously as practicable, but no later than the applicable attainment date.[36] Nonattainment areas that cannot attain the standards by the attainment date may have sanctions and fines imposed pursuant to 42 U.S.C § 7509.[37]

In the case of ozone nonattainment areas, the EPA has a statutory obligation[38] to identify nonattainment areas that do not attain the ozone standards by the required attainment date. The EPA may prepare a *Federal Register* notice announcing the agency's "Determinations of Attainment by the Attainment Date," or DAAD, that identifies the areas that failed to attain by the attainment date. The DAAD may also name nonattainment areas that were attaining by the attainment date, and those areas for which the EPA intends to approve a 1-year extension of the attainment date. Nonattainment areas that fail to attain by the attainment date are "reclassified" (bumped up) to the next most protective classification (*e.g.*, a Moderate nonattainment area would be reclassified as a Serious nonattainment area).

This detailed information about a nonattainment area may be helpful to inform decision-makers as they consider the significance of a Federal Action's air quality impact as assessed under NEPA. The attainment date may be useful to identify a nonattainment area that could be subject to reclassification to a higher, more protective classification during the timeframe an agency is preparing the NEPA document or a conformity evaluation. Review of a DAAD issued for the nonattainment area may reveal the area is recovering and may be eligible to request redesignation to attainment during the timeframe an agency is preparing the NEPA document or a conformity evaluation.

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[34] Nonattainment classifications are assigned consistent with the table included in the *Federal Register* notice.

[35] 42 U.S.C § 7506(c)(6).

[36] 42 U.S.C §7502(a)(2) .

[37] Attainment date and determining whether a nonattainment area was attaining a NAAQS by the attainment date is explained in the Appendix.

[38] 42 U.S.C §7511.

2.2.4. Attainment of the Standards and Maintenance Areas

At the time the EPA promulgates a new or revised NAAQS, one of the first objectives is for the EPA to identify the areas not attaining the standards, and the remainder of the country is, therefore, designated attainment. Lacking evidence of nonattainment, attainment areas can be described as distinctly defined geographical areas of the country where the EPA finds no evidence that the primary or secondary standards are not being met for one or more of the criteria pollutants. Generally, Federal Actions are subject to fewer federal or state air pollution control requirements, such as CAA conformity, when the actions are proposed to occur within attainment areas for the NAAQS.

When a State can successfully demonstrate that a nonattainment area attained the NAAQS, and the claim can be supported by quality-assured monitoring data, the state can request EPA to approve a "Clean Data Determination" or CDD, demonstrating the area attained the NAAQS. The state can also submit an application to EPA for approval to "redesignate" the area to attainment pursuant to 42 U.S.C § 7407(d)(3)(E).[39]

A state may receive approval of their CDD request but decide not to submit an application for redesignation to attainment—it is the States' prerogative. However, if the State wants the area to be redesignated attainment, the State must submit, and the EPA must approve, the application for redesignation.[40] Thus, attaining the standard is not the same as demonstrating the area has attained the NAAQS. Also, a nonattainment area listed in a DAAD as attaining the standard is neither a CDD nor sufficient to support an application for redesignation to attainment.

In its application to redesignate to attainment, in addition to the requirement to provide supporting monitoring data, the State must submit to EPA a revision to the SIP.[41] The submittal must provide evidence supporting the attainment request, along with the State's plan to maintain the standard. This "maintenance plan"[42] must be approved pursuant to CAA section 175A (42 U.S.C § 7505a) and describe the enforceable emission reduction strategies and methods the state will implement to maintain the standard for a period of at least 20 years[43] beyond the effective date of the approved

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[39] The state must submit, and the EPA must approve, the application for redesignation before the area is redesignated attainment. At the State's discretion, even though a CDD has been approved, the State is not required to submit an application for redesignation. Therefore, the area remains a designated nonattainment area.

[40] 42 U.S.C §7407(d)(3).

[41] 42 U.S.C §7407(d)(3)(E)(ii).

[42] CAA section 175A(a) maintenance plan revisions apply only for the primary standard and does not apply to the secondary standard even if one exists. Therefore, conformity for activities proposed to occur within a NAAQS maintenance area that is otherwise subject to CAA section 176(c) conformity requirement must be demonstrated only for the primary standard. The general framework for the contents of a maintenance plan is given in the Memorandum from John Calcagni, Director, EPA Air Quality Management Division, dated September 4, 1992, available at https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19921028_calcagni_sip_redesignation_requirements.pdf

[43] The 10-year maintenance plan submitted at the time of redesignation under CAA section 175A(a) is referred to as the "first 10-year maintenance plan." If the state maintains attainment of the NAAQS, then under CAA section 175A(b), the state must submit its second 10-year maintenance plan before the first 10-year plan expires, which

redesignation.[44] Thus, the area becomes an "attainment area operating under a maintenance plan." However, a section 175A-approved maintenance plan applies only for a primary standard. Such "maintenance areas" are subject to the 42 U.S.C § 7506(c) conformity requirement in much the same way as nonattainment areas. The area may also be subject to the Prevention of Significant Deterioration (PSD) program requirements at 40 CFR 51.166, which apply only for attainment areas.

2.2.5. State Implementation Plans

Each state has the primary responsibility for assuring air quality within its entire geographic area by submitting an implementation plan that will specify the manner in which the NAAQS will be achieved and maintained within each nonattainment area in the state.[45] The State Implementation Plan (SIP) is a collection of air quality measurements, modeling, regulations, controls, programs, and other measures used to identify air quality issues and to remedy or prevent violations of the NAAQS. Likewise, Tribal Nations are responsible for developing Tribal Implementation Plans (TIPs) to address air quality (herein SIP in most cases refers to both SIPs and TIPs).[46] Within the timeframe identified in the EPA's SIP requirements for each new or revised NAAQS, states must submit an "Infrastructure SIP" to EPA regardless of whether or not there are any designated nonattainment areas in their jurisdiction. The purpose of the Infrastructure SIP is to demonstrate that a state has the legal authority, regulatory structure, and necessary resources to implement and enforce the NAAQS as required by the CAA.

A SIP must contain certain "elements" required under the CAA for nonattainment and maintenance areas[47] and include the following, as applicable for the area's status:

- *Attainment Demonstration*[48] – Contains ambient monitoring, emissions inventory, modeling, and proposed control strategies for the initial year, interim year(s), and attainment year as established by the CAA supporting a demonstration to EPA that the NAAQS will be attained by CAA-required deadlines;
- *Control/Program SIP* – Documents the initiation or revision of specific control measures necessary to demonstrate attainment or otherwise show CAA compliance (e.g., vehicle

extends the maintenance plan to a full 20 years beyond the effective date of the redesignation. However, regardless of whether the state submits its second 10-year maintenance plan, the area is considered a "maintenance area" for purposes of the CAA conformity requirement under section 176(c)(5)(B) for the full 20 years beyond the effective date of the redesignation. The area may appear in the EPA Green Book database as a maintenance area beyond the 20 years.

[44] The effective date of the redesignation is given in the *Federal Register* notice of the final rule wherein the EPA approves the redesignation. Usually the final rule is effective 30 days after the date of publication.

[45] 42 U.S.C §7407(a), *Air quality control regions*.

[46] 42 U.S.C. §7601(d), Tribal authority; 42 U.S.C. §7410(o), Indian tribes.

[47] 42 U.S.C §7410(a)(1), *State implementation plans for national primary and secondary ambient air quality standards*

[48] 42 U.S.C §7410(a)(1) and (a)(2), *State implementation plans for national primary and secondary ambient air quality standards*

inspection/maintenance programs, fee programs, and reasonably-available control measures (RACM), including reasonably available control technology (RACT));

- *Maintenance Plan* – If the state is requesting redesignation from nonattainment to attainment, the SIP must contain a maintenance plan prepared for approval under CAA section 175A.[49] The maintenance plan is valid for 10 years from the effective date of redesignation, and is extended for an additional 10 years per the requirements of CAA section 175A, for a total of 20 years, after which the area is redesignated as attainment; and
- *Milestone/Progress SIP*[50] – Also known as Rate of Progress or Reasonable Further Progress Plans (ROP/RFP), these are only required for certain O_3 nonattainment areas, showing that plans and controls designed to attain the NAAQS will decrease nonattainment area emissions by at least 15 percent in the first six years and by 9 percent every three years thereafter until the standard is attained.

Special purpose plans can also be prepared to address unique issues in select nonattainment or maintenance areas, such as transport of pollutants across large areas in the case of O_3, and the formation of regional haze in the case of PM.

2.2.6. CAA Conformity Requirements Overview

Conformity under 42 U.S.C § 7506(c) ensures that applicable federal actions proposed to occur within maintenance areas and EPA-designated nonattainment areas for any NAAQS will not interfere with plans established by States and tribes to attain and maintain federal and state/tribal air quality standards. Therefore, the conformity requirement limits federal government support, including providing financial assistance, or approving activities that do not conform to the air pollution prevention and control requirements of a State Implementation Plan (SIP) or a Tribal Implementation Plan (TIP).[51] Likewise, conformity is demonstrated by affirmatively showing a Federal Action is consistent with the SIP/TIP. The conformity requirements are designed to ensure that emissions associated with proposed Federal Actions do not cause additional air emissions that could:

- cause or contribute to new violations of any NAAQS in any area;
- increase the frequency or severity of any existing violation of any NAAQS; or
- delay timely attainment of any NAAQS or interim emission reductions.

There are two types of Federal Actions for which the conformity requirement uniquely applies—transportation actions and non-transportation actions, the latter being referred to as "general" actions. The EPA established regulations for implementing the conformity requirements for both types of actions and codified those rules under 40 CFR part 93 "*Determining conformity of federal actions to state or federal implementation plans.*"

Transportation Conformity – Under 40 CFR part 93, subpart A, transportation conformity applies to metropolitan planning organization (MPO) or US DOT adoption, acceptance, approval, or

[49] 42 U.S.C. §7505a *Maintenance Plans*

[50] 42 U.S.C. §7511a (c) (2) (B) Plan submissions and requirements

[51] 42 U.S.C. § 7506 *Limitations on certain Federal assistance.*

support of transportation plans or transportation programs. Transportation conformity also applies to the approval, funding, or implementation of Federal Highway Administration/Federal Transit Administration projects, which are defined in 40 CFR 93.101.[52]

General Conformity –Under 40 CFR part 93, subpart B, any Federal Action not covered under transportation conformity is considered a general action subject to General Conformity.[53] Airport projects that involve ground access to aviation facility include general actions but may also include actions that are subject to transportation conformity regulations.

Additional detailed discussion of conformity under the CAA is contained in Chapter 8.

2.2.7. Indirect Source Review

Indirect source review (ISR) requirements are state-specific, and some states' SIPs may require an ISR when proposed Federal Actions are located in maintenance areas or nonattainment areas[54]. Indirect sources may include highways, parking facilities, sports and entertainment facilities, and office buildings. Any applicable indirect source requirements should be identified as early as possible during the NEPA scoping process and described in the NEPA assessment of air quality.

States that require ISR generally establish thresholds for the applicability of ISR. For example, a state may require ISR for all Federal Actions that increase total airport throughput at an airport by more than 100,000 passengers per year, add 1,000 new parking spaces, or increase aircraft operations by 1,000 per year. Federal Actions that exceed the ISR thresholds could be required to complete an indirect source analysis and obtain an indirect source permit from the state.[55]

2.3. Regulatory Agencies

There is a wide range of federal, state, local, and tribal governmental agencies involved in air quality management throughout the U.S. The primary regulatory agencies with jurisdiction in the management of air quality as it pertains to FAA-supported activities are summarized in **Table 2-2** (*Regulatory Agencies*) along with synopses of their roles and responsibilities.

Table 2-2. Regulatory Agencies

Agency	Roles and Responsibilities
U.S. Environmental Protection Agency (EPA)	Sets national clean air policies under the CAA, establishes emissions standards, promulgates the NAAQS, reviews and approves air quality plans.

[52] 40 CFR 93.101 and 93.102 EPA, *Transportation Conformity*, .

[53] 40 CFR 93.153. EPA, *General Conformity*, https://www.epa.gov/general-conformity.

[54] 42 USC § 7410(a)(5) Adoption of plan by State; submission to Administrator; content of plan; revision; new sources; indirect source review program; supplemental or intermittent control systems

[55] FAA Order 1050.1 and accompanying Desk Reference, https://www.faa.gov/regulations_policies/orders_notices/.

Agency	Roles and Responsibilities
Federal Aviation Administration (FAA)	Responsible for implementing NEPA and ensuring CAA compliance as it pertains to aviation actions. Coordinates with EPA on the environmental regulation of aviation equipment and fuels.
Federal Highway Administration (FHWA)	Provides financial assistance and some approvals for road and highway projects. FHWA must examine the environmental impacts of its actions in accordance with NEPA and the Transportation Conformity Rule. FHWA assists state and local air quality planning in determining emissions from local transportation plans.
Federal Transit Administration (FTA)	Provides financial assistance for transit projects. FTA must examine the environmental impacts of its actions in accordance with NEPA and the Transportation Conformity Rule. FTA assists state and local air quality planning in determining emissions from local transportation plans.
Metropolitan Planning Organizations (MPO)	Local governmental agencies with direct responsibility to prepare air quality-related transportation plans. Also assist in local planning with regard to development of local control strategies for on-road and non-road mobile sources.
State and Tribal Air Quality Agencies	Implement and enforce air quality programs state-wide or on tribal lands within the tribe's jurisdiction,[56] including those pertaining to ambient air monitoring, stationary source permitting and smoke management. Also involved in the development of air quality plans in EPA-designated nonattainment or maintenance areas.

[56] 40 CFR 49.3.

3. Air Emissions and Pollutants of Concern

This section discusses the various types of emission sources associated with aviation and the principal kinds of emissions associated with these sources.

3.1. Emission Sources

A variety of emission sources are associated with aviation. To account for this variation, and for the purpose of this *Handbook*, these emission sources have been grouped into the following six categories:

- Aircraft[57]
- Auxiliary Power Units
- Ground Support Equipment
- Stationary/Area[58]
- Ground Access Vehicles
- Construction

Computational methods and modeling techniques for assessing aircraft related emissions and their air quality impacts are discussed in Section 6 (Preparing an Emissions Inventory) and Section 7 (Conducting Dispersion Modeling).

3.1.1. Aircraft

Aircraft emissions sources are typically associated with the aircraft main engines. The types of aircraft include commercial (air carrier and cargo), air taxi, GA, and military aircraft.

Commercial aircraft are operated by civilian international, national, regional, and commuter air carriers and charter operators. Cargo aircraft are designed for the commercial transport of freight. Air taxis are non-air carrier commercial operators that fly scheduled service carrying passengers and freight on a limited basis. GA aircraft are privately owned and operated on a non-scheduled basis at a variety of facilities ranging from large commercial airports to small privately-owned airports. Military aircraft are operated by the U.S. Department of Defense (DOD) and include the full spectrum of aircraft types, ranging from high performance jet fighters to large transports to

[57] For the purpose of modeling emissions in Aviation Environmental Design Tool (AEDT), rotorcraft are treated differently than fixed wing aircraft and commercial space vehicles are modeled outside of AEDT.

[58] The stationary and area sources found at airports are typically categorized as either combustion sources or non-combustion sources. Combustion sources may include boilers and heaters, generators, snowmelters, incinerators, fire training facilities, and aircraft engine testing. Non-combustion sources may include fuel storage tanks, cooling towers, coating and painting operations, de-icing and anti-icing operations, solvent degreasing, salt and sand piles.

small piston engine training aircraft. Most military aircraft operations occur at DOD-operated air bases, but many operations also take place at joint-use and/or civilian airports.

The aircraft main engine(s) is what propels the aircraft forward and is generally classified as either a gas turbine turbofan, turbojet, or turboprop engine fueled with aviation kerosene (i.e., jet fuel or Jet A) or an internal combustion piston engine fueled with aviation gasoline (commonly known as "avgas" or 100 octane low-lead "100LL"). Aircraft engines produce emissions from the combustion of fuel which varies depending on aircraft engine type, fuel type, number of engines, power settings, amount of fuel burned, and other variables (e.g., temperature, altitude, etc.).

It should be noted that many unmanned aircraft systems (UAS) rely on battery stored energy and thus have no direct emissions during flight. Commercial space vehicles are aircraft but many of the protocols for emission quantification of space vehicles are rapidly evolving.

For detailed instructions and guidance on how to compute aircraft engine emissions refer to the *AEDT Technical Manual*.

3.1.2. Auxiliary Power Units

Auxiliary Power Units (APUs) are smaller turbine engines that provide power to an aircraft during approach, while taxiing, or while positioned at the terminal gate. APUs power the aircraft's instruments, lights, heat and air conditioning, and other equipment and are used for starting the main aircraft's engines. APUs burn jet fuel and are common on both large commercial and military aircraft and some air taxi and GA aircraft.

APUs typically remain in use while the aircraft is parked and serviced at the gate, unless an alternative source of electricity and preconditioned air is made available. In such cases, APUs are reactivated several minutes before the aircraft leaves the gate or parking space. Normally, APUs are turned off after the main engines have been started, prior to takeoff.

For detailed instructions and guidance on how to compute APU emissions, refer to the *AEDT Technical Manual*.

3.1.3. Ground Support Equipment

Ground Support Equipment (GSE) is a term used to describe the equipment that service aircraft while loading and unloading passengers and freight at an airport. The types of GSE and their use depend on the aircraft type and the designated category of an aircraft operation (e.g., passenger, cargo, etc.). GSE consists of aircraft tugs, air start units, forklifts, tractors, air-conditioning units, ground power units (GPUs), baggage tugs, belt loaders, fuel or hydrant trucks, catering trucks, cabin trucks, deicer trucks, water trucks, lavatory trucks, and cargo loaders, among others.

Air emissions resulting from the operation of GSE vary depending on the number and type of equipment used to service each aircraft, along with the duration of equipment operation per aircraft landing-takeoff (LTO) cycle and the fuel type (e.g., gasoline, diesel, propane, electric, etc.).

For detailed instructions and guidance on how to compute GSE emissions, refer to the *AEDT Technical Manual*.

3.1.4. Ground Access Vehicles

Ground access vehicles encompass motor vehicles traveling upon on- and off-airport roadways, within airport parking facilities, and idling along terminal curbsides. These include airport passenger vehicles (e.g., private autos, taxis/limos, shuttles, vans, buses, rental cars, etc.); vehicles transporting airport and tenant employees; and vehicles transporting cargo to and from the airport.

Air emissions associated with these vehicles are a function of traffic volumes and speeds, distances traveled, vehicle operating characteristics, fuel type, and ambient conditions.

For detailed instructions and guidance on how to compute ground access vehicle emissions refer to EPA's *MOVES User Guide.*

3.1.5. Stationary and Area Sources

Stationary and area sources of air emissions at airports consist of both fuel combustion and non-combustion sources. Typical sources include boilers, heaters, generators, snowmelters, incinerators, live-fire training facilities, aircraft engine testing, fuel storage tanks, cooling towers, coating and painting operations, de-icing and anti-icing operations, solvent degreasers and sand/salt piles.

Air emissions associated with fuel combustion are a function of equipment type, equipment size, fuel type, combustion processes, and air emission control measures. Non-combustion sources typically emit evaporative emissions (e.g., fuel storage tanks) and/or fugitive dust emissions (e.g., sand and salt piles).

For detailed instructions and guidance on how to compute stationary/area emissions refer to EPA's *AP-42 Compilation of Air Emissions Factors.*

3.1.6. Construction

Construction activities are temporary and variable depending on location, duration, and level of activity and are generally confined to a construction site and access/egress roadways. These emissions occur predominantly from the operation of heavy construction equipment (e.g., backhoes, bulldozers), on- and off-road vehicles used for the transport and delivery of supplies and material (e.g., cement trucks, dump trucks), and on-road vehicles used by construction workers getting to and from a construction site (e.g., cars, pick-up trucks). Construction emissions also include fugitive dust produced from construction materials staging, demolition, and earthwork activities, as well as evaporative emissions from asphalt paving operations.

For detailed instructions and guidance on how to compute construction-related emissions refer to EPA's *MOVES User Guide.*

3.1.7. Other Sources

Other sources of air emissions associated with aviation in general, and airports in particular are of emerging interest because of their connection to G emissions. These include the following:

- Electrical Usage – Emissions associated with the generation of electricity using coal, oil, or natural gas;

- Refrigerants – A range of chemicals used for refrigeration and air conditioning that are comprised of substances possessing high global warming characteristics (e.g., Freon, chlorofluorocarbons, etc.); and
- Waste Management – Emissions associated with solid waste generation and the recycling and solid waste disposal practices employed by the airport/on-ground facilities.

3.2. Pollutants of Concern

There are a variety of air pollutants associated with aviation-related activities that can potentially have an impact on the environment. This section identifies and discusses these pollutants which consist of EPA's criteria pollutants and their precursors, GHGs, and HAPs.

3.2.1. Criteria Pollutants

As discussed in **Section 2** (*Regulatory Framework*), the EPA has established the NAAQS under the CAA for six common air pollutants known as "criteria pollutants." These air pollutants consist of CO, Pb, NO_2, O_3, PM, and SO_2. The criteria pollutants are generally described in **Table 3-1** (*EPA Criteria Air Pollutants*).

Table 3-1. EPA Criteria Air Pollutants

Pollutant	General Characteristics
Carbon Monoxide (CO)	Carbon monoxide is a colorless, odorless, tasteless gas that is a product of incomplete combustion of organic materials. In the ambient environment, it may temporarily accumulate into localized "hot-spots," especially in calm weather conditions and in the wintertime when CO forms easily and is chemically most stable. In humans, CO can be absorbed by the lungs and reacts with hemoglobin to reduce the oxygen-carrying capacity of the blood. At elevated concentrations, CO can have cardiovascular and central nervous system effects.
Lead (Pb)	Lead is a heavy metal that occurs in the atmosphere as lead oxide aerosol or lead dust. Lead is most commonly associated with emissions from industrial sources including incineration, steel production, smelting, and battery manufacturing. Most avgas (general aviation fuel for piston engines) also contains lead. Lead is a highly stable compound that accumulates in the environment and in living organisms. In humans, lead exposure can interfere with the maturation and development of red blood cells, affect liver and kidney functions, and cause nervous system damage.
Nitrogen Dioxide (NO_2)	Nitrogen dioxide is a reddish-brown to dark brown gas with an irritating odor. NO_2, nitric oxide (NO), and the nitrate radical (NO_3) are collectively called oxides of nitrogen (NO_x). These three compounds are interrelated, often changing from one form to another in chemical reactions. The principal man-made source of NO_x is fuel combustion in motor vehicles and power plants with aircraft also contributing. NO_2 emissions from these sources are highest during high-temperature combustion conditions. Reactions of NO_x with other chemicals (such as VOCs) can lead to O_3 formation and acidic precipitation. Additionally, secondary PM can be formed within the atmosphere from precursor gases, such as NO_x, through gas-phase photochemical reactions or through liquid phase reactions in clouds and fog droplets. In humans, NO_2 can be a lung irritant capable of producing pulmonary edema at high concentrations and can lead to other respiratory illnesses such as bronchitis and pneumonia.

Pollutant	General Characteristics
Ozone (O_3)	Ozone occurs both in the earth's upper atmosphere and at ground level. O_3 occurs naturally in the upper atmosphere, where it forms a protective layer that shields the earth from the sun's harmful ultraviolet rays. Tropospheric, or ground level O_3, is not emitted directly into the air, but is a result of VOCs and NO_x reacting in the presence of sunlight in the atmosphere. Typically, O_3 levels are highest in warm-weather months. VOCs and NO_x are termed "ozone precursors" and their emissions are regulated in order to control the creation of O_3. VOCs, which are a subset of hydrocarbons (HC), are released in industrial processes, from mobile sources, and from the evaporation of gasoline, solvents, and other hydrocarbon-based compounds. In humans, O_3 is a pulmonary irritant that affects the respiratory mucous membranes, other lung tissues, and respiratory functions. Exposure to O_3 at high concentrations can result in symptoms such as tightness in the chest, coughing, and wheezing, and can trigger an attack or exacerbate the symptoms of asthma, bronchitis, and emphysema.
Particulate Matter (PM)	Particulate matter is made up of small solid particles and liquid droplets suspended or settling out of the atmosphere. PM consists of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. PM can be formed from both natural and man-made sources including forest fires and wind erosion over exposed soils (i.e., fugitive dust); the incineration of solid wastes; and as an exhaust product from internal combustion engines. Of growing concerns are the effects of PM on visibility and the potential impairment to human health by small PM (i.e., ultrafine particle emissions or $PM_{0.1}$). The regulatory standards for PM are segregated by sizes: less than or equal to 10 micrometers (denoted PM_{10}) and less than or equal to 2.5 micrometers (denoted $PM_{2.5}$). • PM_{10} represents the category of particulates categorized as "inhalable coarse" PM (i.e., with an aerodynamic diameter of 10 microns or less). PM_{10} includes solid and liquid material suspended in the atmosphere. PM_{10} is formed as a result of incomplete fuel combustion, industrial processes, or wind erosion; examples of PM_{10} include dust, fog, and fumes. The level of PM_{10} in the atmosphere is largely affected by wind and rainfall conditions. • $PM_{2.5}$ represents the category of particulates categorized as "fine" PM (i.e., with an aerodynamic diameter of 2.5 microns or less). These particles are more characteristically formed from the combustion of fuel and a variety of other industrial processes. PM_{10} and $PM_{2.5}$ are considered a health risk in humans because of their ability to penetrate into the human respiratory system.
Sulfur Dioxide (SO_2)	Sulfur dioxide is a colorless gas also with a strong characteristic odor. SO_2 is emitted into the atmosphere by both natural processes and by man-made sources such as the combustion of sulfur-containing fuels and sulfuric acid manufacturing. When combined with other substances in the air, SO_2 can precipitate out as rain, fog, snow, or dry particles (commonly referred to as "acid rain"). Sulfate particles are a major cause of reduced visibility in many areas of the U.S. In humans, the inhalation of elevated concentrations of SO_2 can cause irritation of the mucous membranes, bronchial damage, and can exacerbate pre-existing respiratory diseases such as asthma, bronchitis, and emphysema.

Source: EPA, *Six Common Air Pollutants*, 2013, https://www.epa.gov/criteria-air-pollutants/.

3.2.2. Hazardous Air Pollutants

Hazardous air pollutants (HAPs) are pollutants for which there are no NAAQS, but are still regulated under the federal CAA because of their potentially adverse effects on human health and

the environment. Also known as "air toxics," these pollutants are comprised of a wide array of organic and inorganic compounds (e.g., formaldehyde, 1 acetaldehyde, benzene, toluene, acrolein, 1,3-Butadiene, xylene, lead, naphthalene, propionaldehyde). In relation to aviation sources, such emissions are present in the exhaust of aircraft, APUs, GSE, and motor vehicle engines and, to a lesser extent, of boilers, fuel facilities, and other stationary sources.

For a detailed discussion on when and how to assess HAPs associated with aviation, refer to **Section 6.2** *(Hazardous Air Pollutants)* and the AEDT *User Guide* and *Technical Manual*.

3.2.3. Greenhouse Gases

Greenhouse gases (GHGs) are pollutants for which there are no NAAQS and are emitted principally from the combustion of fossil fuels, decomposition of waste materials, and deforestation. GHGs are linked to a phenomenon called the "greenhouse effect."

According to the Intergovernmental Panel on Climate Change (IPCC) the six main GHGs whose emissions are related to human activities (e.g. combustion of fossil fuels, agriculture, land use change) are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), which are typically reported as carbon dioxide equivalents (CO_{2e}).[59]

GHG emissions associated with aviation are principally in the form of CO_2 and are generated by aircraft, APUs, GSE, motor vehicles, and an assortment of stationary sources. For the most part, CO_2 emissions from these sources arise from the combustion of fossil fuels (e.g., jet fuel, avgas, diesel, gasoline, compressed natural gas [CNG]) and are emitted as by-products contained in the engine exhausts. Other GHGs associated with airport operations include CH_4, water vapor (H_2O), soot, and sulfates – but are emitted by airports to a far lesser extent than CO_2. Emissions of HFCs, PFCs, and SF_6 are most commonly linked with refrigeration, air conditioning, and other coolants.

For a detailed discussion on when and how to assess GHGs associated with aviation, refer to **Section 6.3** *(Greenhouse Gases)*.

Table 3-2 (*Sources of Air Emissions and Pollutants of Concern at Airports)* provides a summary listing aviation-related sources of air emissions and the types of pollutants they emit.

[59] EPA defines CO_{2e} as a metric measure used to compare the emissions from various GHGs based upon their Global Warming Potential (GWP).

Table 3-2. FAA summary of sources of air emissions and pollutants of concern at airports

Source		Pollutants	Characteristics
Aircraft[1]	Main engine(s)	CO, VOC, NO_x, PM_{10} and $PM_{2.5}$, SO_2, Pb, GHGs (i.e., CO_2, CH_4[1], N_2O), and HAPs[2]	Emitted as the exhaust products of fuel combustion in aircraft engines. The quantities and types can vary based on engine power setting and duration of operation. Emissions are generally assessed based on a typical LTO cycle (i.e., taxi and delay, take-off, climb-out, approach, landing, and taxi to gate). Lead emissions are an exhaust product from aircraft fueled with leaded avgas.
APUs	Turbine engine		Emitted as the exhaust products of fuel combustion of the turbine engine. The quantities and types can vary based on engine load and duration of operation. Emissions are generally assessed based on a typical LTO cycle (i.e., taxi and delay, take-off, climb-out, approach, landing, and taxi to gate).
GSE	Combustion engines (e.g., aircraft tugs, air start units, loaders, tractors, fuel or hydrant trucks)		Emitted as the exhaust products of fuel combustion from the operation of service trucks and other equipment servicing the aircraft and the airport. Emissions differ by engine type, fuel type, and activity level.
Stationary/ Area	Combustion sources (e.g., boilers, heaters, generators, snowmelters, incinerators, fire training facilities)	CO, VOC, NO_x, PM_{10} and $PM_{2.5}$, SO_2, GHGs (i.e., CO_2, CH_4, N_2O), and HAPs[2]	Results from the combustion of fossil fuels. The combustion sources tend to produce a variety of air pollutants that are released to the atmosphere with combustion gases. The level of emissions of these sources is dependent on type of fuel, usage, and duration of operation.
	Non-combustion sources (e.g., fuel storage tanks, painting operations, de-icing and anti-icing operations, salt/sand storage)	VOC, PM_{10}, $PM_{2.5}$, and HAPs[2]	Emit evaporative emissions from vapor displacement and loss during fuel storage and transfer, and upon application of solvents and coatings. Particulate matter emissions can occur during loading and unloading of the piles and through wind erosion of the pile material.
Ground access vehicles	Passenger vehicles e.g., private autos, taxis/limos, shuttles, vans, buses, rental cars), airport and tenant employee vehicles, airport fleet, and vehicles transporting cargo to and from airport as well as	CO, VOC, NO_x, PM_{10} and $PM_{2.5}$, SO_2, GHGs (i.e., CO_2, CH_4, N_2O) and HAPs	Emitted as the exhaust products of fuel combustion from the operation of passenger, employee and other on-road vehicles approaching, departing, and moving within the airport and its parking facilities. Emissions vary depending on vehicle type (e.g., gasoline, diesel, etc.) and the amount of fuel consumed.

Source		Pollutants	Characteristics
	circulating around the airport.		
Construction	Combustion sources (e.g., heavy construction equipment, on-road vehicles and off-road vehicles)	CO, VOC, NO_x, PM_{10} and $PM_{2.5}$, SO_2, GHGs (i.e., CO_2, CH_4, N_2O) and HAPs	Occur predominantly in the engine exhaust from the operation of construction equipment (e.g., backhoes, bulldozers, graders, etc.), on-road vehicles (e.g., cars, pick-up trucks, vans, etc.), and off-road vehicles (e.g., cement trucks, dump trucks, etc.). Emissions are based on construction activity schedule, number of vehicles/pieces of equipment, the types of equipment, type of fuel used, and vehicle/equipment utilization rates.
	Non-combustion sources associated with construction activities and operations (e.g., construction materials staging, demolition, and earthworks activities, and asphalt paving operations)	PM_{10}, $PM_{2.5}$ and VOC	Evaporative emissions resulting from asphalt paving operations and fugitive dust emissions are from construction materials staging, demolition, clearing and earthworks activities.
Electrical Usage[3]	The generation of electricity using coal, oil, or natural gas.	GHGs (i.e., CO_2, CH_4, N_2O)	Emissions associated with the generation of electricity using coal, oil, or natural gas.
Refrigerants[3]	Compounds used for refrigeration and air conditioning.	GHGs (i.e., HFCs, PFCs and SF_6)	A range of chemicals comprised of substances possessing high global warming characteristics (e.g., Freon, chloroflorocarbons, etc.).
Waste Management[3]	Solid waste generation and the recycling/waste disposal practices employed by the airport.	GHGs (i.e., CO_2, CH_4, N_2O)	Emissions associated with the recycling/waste disposal practices employed by the airport.

[1] Contributions of CH_4 emissions from commercial aircraft are reported as zero. Years of scientific measurement campaigns conducted at the exhaust exit plane of commercial aircraft gas turbine engines have repeatedly indicated that CH_4 emissions are consumed over the full emission flight envelope [Reference: *Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment*, Santoni et al., Environ. Sci. Technol., July 2011, Volume 45, pp. 7075-7082]. As a result, the EPA published that: "…m*ethane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers."* [Reference: EPA, *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines*, May 27, 2009 [EPA-420-R-09-901], https://nepis.epa.gov/Exe/ZyPDF.cgi/P1003YX3.PDF?Dockey=P1003YX3.PDF]. In accordance with the following statements in the *2006 IPCC Guidelines* (IPCC 2006), the FAA does not calculate CH_4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "*Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines." "Current scientific understanding does not allow other gases (e.g., N_2O and CH_4) to be included in calculation of cruise emissions*." (IPCC 1999).

[2] Not all HAPs are emitted by these sources. To identify the type of HAP emitted by this source category refer to the FAA/EPA documents: *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from*

Source	Pollutants	Characteristics
Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines (Version 1.0), May 2009 [EPA-420-R-09-901], https://nepis.epa.gov/Exe/ZyPDF.cgi/P1003YX3.PDF?Dockey=P1003YX3.PDF*;* and *Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources,* Version 1, September 2, 2009, https://cupdf.com/document/guidance-for-quantifying-speciated-organic-gas-emissions-guidance-for-quantifying.html?page=1 .		

[3] GHG emissions from these sources are strictly related to the "activities" of these sources, and thus not considered under the stationary/area source category.

4. Air Quality Assessment Procedure

As discussed in **Section 1** (*Introduction and Background*), the primary role of this *Handbook* is explanatory guidance, which will serve as a tool and resource designed to assist the FAA and stakeholders in the planning, organization, and completion of air quality assessments for aviation-related projects and/or actions that require FAA funding, licensing, permitting, or approval (Section 1 defined these as Federal Actions). Following the guidance in this *Handbook* will help to ensure that air quality assessments for these Federal Actions are comprehensive, consistent, and appropriate for use in the disclosure and decision-making processes, as well as assisting stakeholders in meeting legal requirements.

In the most fundamental terms, the NEPA air quality assessment process described in this Section attempts to assist users quickly and accurately determine if Federal Action-generated emissions are significant[60] and provide sufficient documentation of that assessment.

In addition to the NEPA air quality assessment, this Section also identifies a methodology to ensure that, when necessary, the assessment demonstrates the Federal Action's conformity with a SIP under the CAA section 42 U.S.C § 7506. The purpose of the two processes differ considerably. The NEPA assessment—a procedural requirement—is intended to identify potentially significant impacts of a proposed action (as defined in FAA order 1050.1) for many categories of the environment, including air quality.[61] Conformity—a substantive requirement–is intended to support achieving the NAAQS as expeditiously as possible. The CAA's conformity requirement is independent from the threshold of significance under NEPA for air quality impacts. Importantly, failure to demonstrate an affirmative conformity determination, when the action is subject to the CAA conformity requirement, precludes the federal agency from taking the Federal Action.[62]

Further, in some cases, a portion of a Federal Action may require consideration under the transportation conformity rule (See **Section 8.0 Conformity)**. Although rare, ground access projects should include coordination with the appropriate MPO early and often when there may be interaction with the development of metropolitan Transportation Plans (TP) and metropolitan Transportation Improvement Programs. This is especially valuable for ground access projects in the vicinity of aviation facilities. The MPO also plays an important role in the General Conformity process since a conformity applicability analysis must be based on the latest planning assumptions from the TP, which is put forth by the MPO. Thus, when ground access projects are anticipated to be part of a Federal Action, practitioners should inform the FAA, and the FAA should initiate early coordination with the local MPO to determine if the Federal Action will be subject to the Transportation Conformity regulations. The analysis necessary to fulfill the CAA conformity requirement (general and transportation) is covered fully in **Section 8.**

The flowchart in **Figure 4-1** (*Air Quality Assessment Process for a federal action*) shows the general steps needed to complete an air quality assessment under NEPA. Each of these steps are

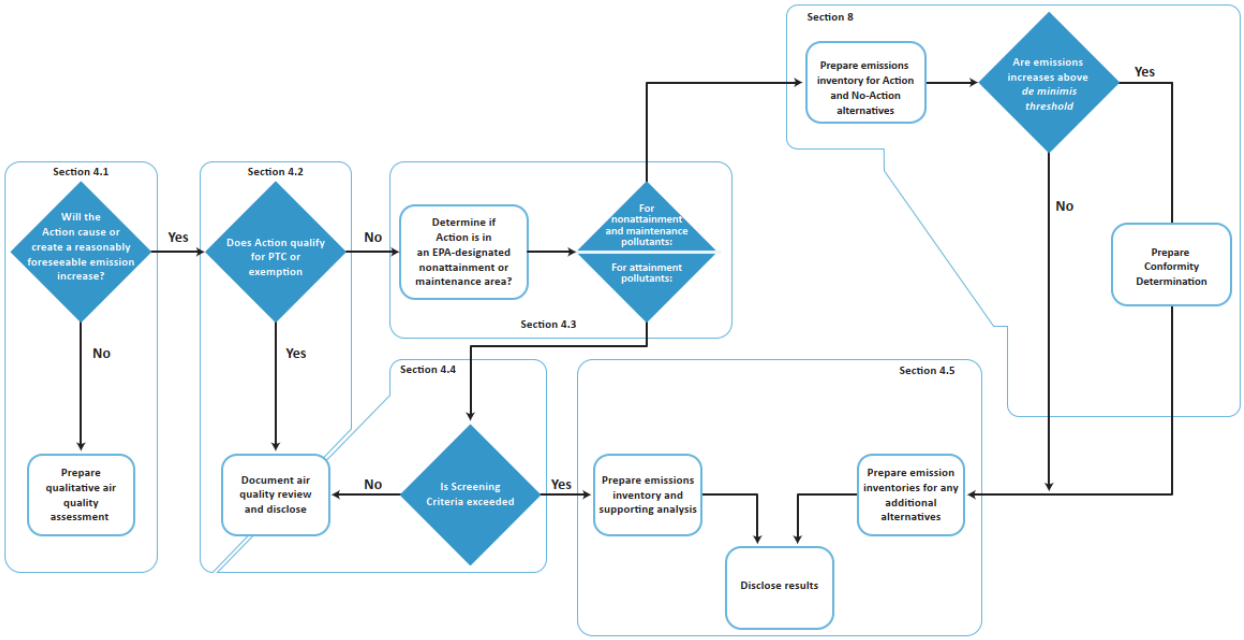
[60] A Federal Action would be significant if the action would cause pollutant concentrations to exceed one or more of the National Ambient Air Quality Standards (NAAQS) as established by the Environmental Protection Agency under the Clean Air Act, for any of the time periods analyzed, or to increase the frequency or severity of any such existing violations. (FAA Order 1050.1F, Exhibit 4-1)

[61] 40 CFR 1500.1 ***/***

[62] 40 CFR 93.150.

fully described in the following paragraphs. This assessment process is intended for projects requiring a Federal Action as described in **Section 2 (***Regulatory Framework)*. It is important to note that all reasonably foreseeable[63] emissions (i.e. construction and operational) associated with a Federal Action need to be considered in this analysis.

Figure 4-1. Air quality assessment process for a Federal Action to satisfy NEPA and CAA conformity requirements



4.1. Step 1: Determine if the Federal Action falls within an exemption to General Conformity

The General Conformity regulations contain a list of exempt actions, including a list of 22 exempt actions that would result in no emissions increase or an increase in emissions that is clearly *de minimis*.[64] If the Federal Action is exempt, the General Conformity requirements do not apply. To offer some examples, Table 4-1 presents the five most common Federal Actions undertaken by the FAA that are listed as exempt because they result in no emissions increase or an increase in emissions that are clearly *de minimis*. In addition, two other exemptions that sometimes are a factor in FAA Federal Actions are listed in Table 4-1. It is important to note that Table 4-1 is not a comprehensive list of exempt actions, instead it is simply a summary of those most common to the FAA.

63 "Reasonably foreseeable emissions" is defined in 40 CFR 93.152 of the CAA implementing regulation, and "reasonably foreseeable" is defined at 40 CFR 1508.1 of the NEPA implementing regulations.

64 40 CFR 93.153(c)(2).

Table 4-1. List of exempt actions most commonly associated with FAA Federal Actions

1. Rulemaking and Policy Development and Issuance [40 CFR 93.153(c)(2)(iii)]
2. Routine Maintenance and Repair Activities [40 CFR 93.153(c)(2)(iv)]
3. Planning, Studies, and Provisions of Technical Assistance [40 CFR 93.153(c)(2)(xii)]
4. Transfers of Ownership, Interests, and Titles in Land, Facilities, and Real and Personal Properties, Regardless of the Form or Method of the Transfer [40 CFR 93.153(c)(2)(xiv)]
5. Actions (or Portions Thereof) Associated With Transfers of Land, Facilities, Title, and Real Properties Through an Enforceable Contract or Lease Agreement Where the Delivery of the Deed Is Required To Occur Promptly After a Specific, Reasonable Condition Is Met, Such as Promptly After the Land Is Certified as Meeting the Requirements of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and Where the Federal Agency Does Not Retain Continuing Authority To Control Emissions Associated With the Lands, Facilities, Title, or Real Properties [40 CFR 93.153(c)(2)(xix)]
6. Alterations and Additions of Existing Structures as Specifically Required by New or Existing Applicable Environmental Legislation or Environmental Regulations (e.g., Hush Houses for Aircraft Engines * * *) [40 CFR 93.153(d)(4)]
7. Federal Actions Which Are Part of a Continuing Response to an Emergency or Disaster [40 CFR 93.153(d)(2) and (e)]
8. Air traffic control activities and adopting approach, departure, and enroute procedures for aircraft operations above the mixing height specified in the applicable SIP or TIP. Where the applicable SIP or TIP does not specify a mixing height, the Federal agency can use the 3,000 feet above ground level as a default mixing height, unless the agency demonstrates that use of a different mixing height is appropriate because the change in emissions at and above that height caused by the Federal action is *de minimis.*

If the project qualifies as exempt under 40 CFR 93.153, the NEPA analysis should document this finding in the air quality analysis with a notation, such as "*the action is deemed to be exempt pursuant to CFR 93.153*" *and then cite to the specific sub-section within 93.153 that applies to the action.* Depending on the circumstance, this notation may simply be a restatement of the above sentence, or may include evidence and planning documents supporting this conclusion. If there is a potential decrease in emissions this should likewise be documented in the NEPA analysis. It is advisable in these cases to make note that the CAA conformity requirement was reviewed, and the requirement is not applicable.

The list of exempt and clearly *de minimis* actions is specific to analysis under the General Conformity regulations (i.e. for nonattainment and maintenance pollutants). Given that anything included on the list was unlikely to cause a significant impact in a nonattainment area, it is safe to conclude these project types would not cause a significant impact in an attainment area. Therefore, the analysis of emissions for attainment pollutants (i.e. air quality analysis under NEPA) can be satisfied if a major federal action qualifies as exempt under 40 CFR 93.153. For attainment pollutants, this would be documented as described in the preceding paragraph.

In the rare case where there are scientific analyses that would provide additional information to help determine if there are significant impacts, nothing in this document precludes FAA from seeking a more comprehensive analysis. If the project is not exempt under 40 CFR 93.153, the analysis should continue to Step 2.

4.2. Step 2: Does the Federal Action qualify as Presumed to Conform?

The General Conformity regulations have detailed specifications about the applicability of the regulations to Federal Actions. It is important to be aware of the FAA's development of a Presumed to Conform list that may also exclude Federal Actions from review under the General Conformity regulations.[65] This step is deliberately set to occur before the consideration of the attainment status of the region.

In July 2007, the FAA developed a list of actions that are Presumed to Conform (PTC) pursuant to the General Conformity regulations (72 *Federal Register* 41565; summarized in **Table 4-2**). Please note that it is important to review the actual Federal Register document containing the FAA's PTC list as there are limitations that may not be fully captured by the summarized list in **Table 4-2.**

The General Conformity requirements only apply to Federal Actions proposed to occur within nonattainment or maintenance areas, to ensure that a Federal Action does not cause or contribute to a violation of the NAAQS, or delay timely attainment of the NAAQS.[66] The FAA published the PTC list in 2007 in the Federal Register for the purpose of screening projects in nonattainment areas.[67] In that notice, FAA also identified activities that may qualify for an existing exemption from General Conformity. Given that anything included on the PTC list was unlikely to cause a significant impact in a nonattainment area, it is safe to conclude these project types would not cause a significant impact in an attainment area. Therefore, the analysis of emissions for attainment pollutants (i.e. air quality analysis under NEPA) can be satisfied by determining that a major federal action qualifies for the PTC list.

It is noted that there are two types of PTC actions: 1) some actions would be very unlikely to ever exceed the *de minimis* threshold and thus do not include any numeric threshold as a condition of their designation of PTC; and 2) PTC actions that have the potential to exceed the *de minimis* threshold and thus the PTC list cites a specific numeric threshold as a condition of their designation of PTC.

[65] 40 CFR 93.153 (f)

[66] 40 CFR 93.153 (b)

[67] Federal Presumed to Conform Actions Under General Conformity, 72 FR 41565 (July 30, 2007).

Table 4-2. List of Presumed to Conform Actions

1. *Pavement Markings.
2. Pavement Monitoring Systems.
3. *Non-Runway Pavement Work.
4. Aircraft Gate Areas on Airside.
5. Lighting Systems.
6. *Terminal and Concourse Upgrades.
7. *New HVAC Systems, Upgrades, and Expansions.
8. Airport Security.
9. Airport Safety.
10. Airport Maintenance Facilities.
11. Airport Signage.
12. *Commercial Vehicle Staging Areas.
13. Low-Emission Technology and Alternative Fuel Vehicles.
14. Air Traffic Control Activities and Adopting Approach, Departure, and Enroute Procedures for Air Operations.
15. Routine Installation and Operation of Aviation Navigation Aids.
* - Numeric limits associated with this type of action

4.2.1. Application of Multiple Presumed to Conform Actions

After determining that a Federal Action is not exempt or clearly *de minimis*, the fifteen categories of PTC actions should be evaluated to determine if any are applicable to the proposed action. The description of each PTC action is independent of the description of other PTC actions. In the case of Federal Actions that are within the scope of more than one of the PTC actions, it is permissible to use multiple appropriate PTC actions to complete the air quality analysis.[68]

When using multiple PTC actions for a single Federal Action the FAA needs to contemplate the aggregate impact; a proportional aggregation of individual PTCs with numeric thresholds cannot exceed a numerically combined threshold (explained further below). Beyond this approach, a Federal Action may also rely on 1) a PTC with a numeric threshold to be combined with not more than one PTC without a numeric threshold, and/or 2) multiple PTCs without numeric thresholds.

To better illustrate how a Federal Action containing two actions that fit within the scope of PTCs with numeric thresholds would be analyzed, consider an example of a terminal project (PTC #6) with an associated ramp (PTC #3) being constructed in a serious ozone nonattainment area. For this example, the footprints of the terminal project are assumed to be 50,000 ft^2, and the ramp area is assumed to be 5 acres (217,800 ft^2). In a serious ozone nonattainment area, Table III-1 of the PTC list (72 FR 41570) provides size thresholds for these two project types (92,945 ft^2 and 1,096,929 ft^2, respectively) and this table indicates NO_x is the most constraining pollutant. Thus, in aggregating, the threshold for the terminal space covered by PTC #6 (50,000 ft^2/92,945 ft^2) is 53.8% consumed, and the threshold for the ramp area covered by PTC #3 (217,800 ft^2/1,096,929 ft^2) is 19.9% consumed. Collectively, that means that only 73.7% of the threshold has been consumed and this Federal Action would appropriately be approved using the two PTCs.

When the air emissions analysis for a Federal Action is based on the project category being on either the exempt list or PTC list, the FAA should ensure the specific exemption or PTC that the agency has relied on is properly documented. This should include relevant information supporting the determination. In the case of a Federal Action that relied on a PTC with a numeric threshold, the documentation should include a clear summary of relevant project parameters. No further analysis is required aside from the documentation.

If there is a possibility that significant impacts could occur (as defined in FAA Order 1050.1), nothing in this document precludes FAA from seeking a more comprehensive analysis. Examples of such instances could include: emissions that are very near publicly accessible land and may cause public health impacts, or a Federal Action that results in the emission of hazardous air pollutants and minimal criteria pollutants. It is important to note that the Federal Register publication of the PTC list provided context on the justification for each action on the PTC list. Thus, merely because a proposed action could appear consistent with the brief description in the PTC list does not mean the action qualifies to use the PTC list. For that reason, this document has consistently used the term "**qualifies** for the PTC list".

[68] Federal Presumed To Conform Actions Under General Conformity, 72 FR 41565, 41580 (July 30, 2007) ("*Specifically, the Notice may be used if the project is a single action or if it is limited to multiple presumed to conform actions that are supported in the Notice by additional quantification.* …")

4.3. Step 3: Determine if the Federal Action is in an EPA-designated nonattainment area or maintenance area

This step of the assessment process is to establish the attainment/nonattainment status of the study area and, if applicable, to identify those pollutants for which the area is designated nonattainment or maintenance (see **Section 2** and **Section 8** *(Conformity),* for further descriptions of attainment/nonattainment areas).

The EPA Greenbook[69] contains a current listing of nonattainment and maintenance areas for each criteria pollutant. This assessment should be made for each criteria pollutant. In other words, there are effectively six air quality reviews (one for each criteria pollutant) associated with each Federal Action. For any pollutant for which the area is classified as being in nonattainment or maintenance, further analysis of that pollutant should follow the guidelines contained in **Section 8,** unless the Federal Action has been deemed exempt or presumed to conform.[70]

For the emission of all pollutants where the area is classified as attainment or unclassified, the attainment Screening Criteria (see **Section 4.4**) can be applied. In the case that a pollutant is classified as attainment, but another concurrently emitted pollutant has triggered an escalation of the analysis for the Federal Action to the General Conformity rules, the Federal Action may quantify attainment pollutants according to the methodology specified in the General Conformity rule; if that is more convenient. However, the General Conformity rule should not be used to determine significance of emissions of those attainment pollutants, regardless of whether they are emitted concurrently with nonattainment/maintenance pollutants. Attainment pollutants are not subject to the General Conformity rule and are only subject to NEPA (where the threshold of significance is a violation of the NAAQS).

During this step it is also necessary to determine if the Federal Action will occur in a state that is designated as an Ozone Transport Region (OTR). This is because attainment areas that are located in an OTR have more restrictive air quality requirements under the Clean Air Act. As such, the screening methodology is more cautious for these areas. As of March 14, 2022, 40 CFR 81.457 identified the following states in the OTR: Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, parts of Maine,[71] parts of Virginia,[72] and the District of Columbia. This information is needed for the Screening Criteria outlined in **Section 4.4**.

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[69] EPA, *Green Book*, https://www.epa.gov/green-book

[70] 40 CFR 93.153(b).

[71] 40 CFR 81.457(a) - Ozone Transport Region Boundary: Table 1 to Paragraph (a) - Maine Towns and Cities in the Ozone Transport Region - Androscoggin County (partial), Cumberland County (partial), Hancock County (partial), Knox County (partial), Lincoln County (partial), Sagadahoc County (entire), Waldo County (partial), York County (partial).

[72] 40 CFR 81.457(a) - Ozone Transport Region Boundary: Counties and cities in Virginia - Arlington County, Fairfax County, Loudoun County, Prince William County, Stafford County, Alexandria City, Fairfax City, Falls Church City, Manassas City, and Manassas Park City.

4.4. Step 4: Evaluate if Attainment Screening Criteria is exceeded

4.4.1. Airport Screening Criteria

In assessing the environmental impact of attainment pollutants for a Federal Action at an airport, Screening Criteria[73] are used to determine whether an inventory of projected emissions is required. The screening was developed based on a review by the FAA of criteria pollutant emission inventories for a representative array of major federal actions at airports. In that review, FAA identified a handful of key project parameters that can serve as a proxy for emissions.

A series of questions (see **Section 4.4.1.1** below) are used to evaluate the four Screening Parameters that could cause (or contribute to) changes in airport emissions. The responses to those four questions are project variables that are compared to the Screening Parameters and include: (A) increase in aircraft operations, (B) new aircraft taxi/delay/idle, (C) additional Ground Access Vehicle (GAV) trips by licensed on-road vehicles, and (D) additional construction equipment and/or GSE. Each variable has a corresponding letter (A, B, C, and D) for representation in emissions computations. Collectively, the aggregation of the four Screening Parameters comprises the Screening Criteria for Federal Actions at airports.

- **Project Variable A (Aircraft Operations)**. Increase in number of aircraft LTOs (including changes in GSE and APUs associated with the increase in aircraft operations) as a result of the Federal Action.
- **Project Variable B (Aircraft Taxi Time)**. Increase in delay or changes to the taxi-in and -out times and/or taxi distances by on-ground aircraft as a result of the Federal Action.
- **Project Variable C (GAVs)**. Changes in the Vehicle Miles Traveled (VMT) from GAV trips on airport property driven by on-road vehicles that occur as a result of a Federal Action.
- **Project Variable D (Construction Equipment and/or GSE)**. Number of pieces of construction equipment that are active and working on the Federal Action, and/or the number of pieces of GSE that will be brought to the airport and operated as a direct result of the Federal Action. This does not include GSE increases due to increases in aircraft operations.

In establishing the Screening Criteria, FAA examined a range of criteria used in the CAA that are applied to nonattainment areas in order to determine the possibility of adverse impacts. These criteria included the significant emission rate threshold, the prevention of significant deterioration rules, the definition of major stationary sources, nonattainment new source review thresholds, and ozone transport regulations. In this holistic context of the CAA, it is fair to say if emission increases can prudently by undertaken in nonattainment areas, then there will be no adverse impact to air quality from a comparable emission increase in an attainment area. A technical analysis was performed for each of the four Screening Parameters to determine activity levels which would not

[73] These Screening Criteria have no bearing on the applicability of the CAA conformity requirement to an FAA action.

cause an emission increase greater than levels that the CAA deems acceptable for nonattainment areas. It is important to note that the analysis of activity levels focused on the "worst case" aspects of an activity. As an example, if a fleet of vehicles or equipment includes many low emission models and a couple of high emitting units, the Screening Criteria was established by assuming that all units in a Federal Action would be high emitting units.

There are two key time periods to evaluate with the Screening Criteria—the construction period and the operational period. All four questions need to be answered for each of these periods.

4.4.1.1. Screening Parameter questions

The FAA has identified attributes about Federal Actions at airports that indicate a Federal Action has little chance of causing adverse air quality impacts. For Federal Actions affecting airports, the following four Screening Questions, and accompanying variables, have the greatest causal relationship with adverse air quality impacts. Exceeding the screening metric specified in any of the following four questions triggers the preparation of an emission inventory. It should also be noted that the Screening Questions are not appropriate when there is the potential for significant impacts that require specialized analysis to properly evaluate. The questions comprise the necessary information to make an evaluation of the Screening Criteria:

A. If the project is not in the OTR, will the FAA Federal Action cause an increase in all aircraft operations of more than 14,000 operations per year? If the project is in the OTR, will the FAA Federal Action cause an increase in GA aircraft operations of more than 5,000 operations per year, or an increase in all aircraft operations of more than 14,000 operations per year?

B. Will the FAA Federal Action cause a projected annual increase of aircraft delay exceeding 340,000 minutes?

C. Will the FAA Federal Action cause an additional 25 million vehicle miles traveled (VMT) from on-road vehicles per year?

D. If the project is not in an OTR, will the FAA Federal Action result in the use of an average of more than 125 pieces of construction equipment and GSE during a year? If the project is in an OTR, will the FAA Federal Action result in the use of an average of more than 50 pieces of construction equipment and GSE during a year?

The detail and accuracy of the responses to each of these questions should be reflective of the proximity to the screening threshold – it is unnecessary to spend considerable resources preparing a precise answer when a rough calculation shows the initial value to be far away from the threshold.

When evaluating the Screening Criteria, for increases in aircraft operations, the screening question anticipates that GSE, APU, and ground transportation emissions associated with the increased operations are part of the Screening Criteria. Since GSE support for aircraft operations are included in the aircraft Screening Criteria, only when GSE operations are increasing independent of aircraft operations would they be included in question D (e.g., new bag system requires purchase of 50 new bag tugs due to remote loading location). For the Screening Question on construction equipment and GSE, the emissions were calculated based on 365 days per year of usage at 16 hours per day.

As an example, if a construction project outside an OTR would use 400 pieces of construction equipment for 16 hours per day for only 3 months, this would be converted to an equivalent number of construction equipment – 100. Since this is less than the 125 pieces of equipment specified in the Screening Criteria, the answer to the question would be negative.

4.4.1.2. Emissions from more than one Screening Parameter

If there are emissions associated with more than one of the four Screening Parameters in a given year, it is necessary to aggregate those emissions for comparison to the Screening Criteria. It is important to note that the Screening Criteria is evaluated by calendar year. In other words, these Screening Questions could need to be answered 20 times if a Federal Action's impacts extended across 20 years. However, as discussed in **Section 4.4.1.3** (*Emissions from different years)* it is expected that the analysis can be handled by the use of peak emission years.

When aggregating emissions, each of the four Screening Parameters should be normalized, i.e., divide the anticipated activity level by the Screening Criteria for that Screening Parameter. As an example, for construction equipment, if there were 25 units expected to be on site outside the OTR, this would be divided by the 125-unit Screening Criteria resulting in a normalized value of 0.2.

Each of the normalized values would be added together and if the sum exceeds 1.0, an emission inventory would be required (the same as if one of the Screening Questions had been exceeded). The formula for this aggregation is shown below.

In a given year, if $\boldsymbol{A' + B' + C' + D' \geq 1.0}$*, prepare emissions inventory.*

Where:

A' = Increase in Aircraft LTO's / 14,000*

B' = Increase in Aircraft Taxi/Idle/Delay (minutes) / 340,000

C' = GAV Trips (VMT) / 25,000,000

D' = Number of pieces of GSE and Construction Equipment / 125**

*- 5,000 if the project primarily involves GA aircraft AND is in the OTR

** - 50 if in the OTR

4.4.1.3. Emissions from different years

The Screening Criteria is intended to quickly evaluate the magnitude of air emissions and determine whether the additional resources associated with preparing an emission inventory is justified. In order to effectively make that determination, the FAA can simply look at whether the 'worst case' year exceeds the Screening Criteria. Since operational and construction emissions often don't have a lot of commonalities where one can readily identify the 'worst case' year, it is expected that many Federal Actions will have to evaluate the Screening Questions for at least one construction year and one operational year. In such a case, analysis of multiple construction years, or multiple operational years would not be needed if the 'worst case' year for each of those periods can be reliably identified. It is also typically less common for emissions from construction equipment and emissions from increased aircraft operations to occur in the same year. If they

occur contemporaneously, it would be expected that a peak emissions year for operations, a peak emissions year for construction, and a peak emissions combined year would all be evaluated. Regardless of the exact scenario, it is common for at least a construction year and an operational year to be evaluated relative to the Screening Criteria.

4.4.1.4. Example emissions aggregation

Based on the four Screening Questions, it is instructive to apply the method to some example applications. For the purposes of demonstration, two scenarios are examined. In each of the scenarios, emission changes occur in both the construction period and operational period, but it is assumed there is no overlap of these two periods. If there is overlap between construction and operations, then those Screening Questions should be aggregated using this methodology. Further, all years in the operational period can be represented by a single 'worst case' year. Thus, each scenario contains two analyses.

Scenario–I - Airport "QRS" – ***Approval of funding for a new taxiway at an airport outside an OTR that enhances safety but doesn't contribute or cause a change in its existing aircraft activity.*** In evaluating each question, this Federal Action is expected to cause (A) no additional aircraft operations, (B) 10,000 minutes of additional aircraft taxi time after the construction of the new taxiway is complete (i.e., 1 minute of taxi delay for each of the 10,000 LTOs that are expected to use the new taxiway), (C) 300,000 additional VMT due to longer travel route after the construction of the new taxiway is complete, and (D) 50 pieces of construction equipment. Tables 4-3 and 4-4 show the aggregation results for construction years and operational years, respectively.

Table 4-1. Airport "QRS" Aggregation Results — Construction Years

Variable	Variable Description	Project-Specific Change	Normalization
A	Aircraft Operations	No change	0.00
B	Aircraft Taxi/Idle/Delay	No change	0.00
C	Ground Access Vehicles	No change	0.00
D	Construction Equipment	50 pieces	0.40
		Total	0.40

Source: RoVolus, 2018.

Table 4-2. Airport "QRS" Aggregation Results — Operational Years

Variable	Variable Description	Project-Specific Change	Normalization
A	Aircraft Operations	No change	0.00
B	Aircraft Taxi/Idle/Delay	+ 10,000 minutes	0.03
C	Ground Access Vehicles	+ 300,000 VMTs	0.01
D	Construction Equipment	No equipment	0.00
		Total	0.04

Source: RoVolus, 2018.

In this example, both aggregation results are below 1.0 and therefore the project does not exceed the Screening Criteria. No further action would be required.

Scenario –II - Airport "TUV" – ***FAA funding for construction of a runway extensions at an airport in the OTR that enables larger aircraft to serve the airport***. This project is expected to cause a change of (A) 4,000 additional LTOs, (B) no increase in taxi/idle/delay, (C) 10 million additional VMTs, and (D) the use of 75 pieces of construction equipment. **Table 4-3** and **Table 4-4** show the aggregation results for construction years and operational years, respectively.

Table 4-3. Airport "TUV" Aggregation Results — Construction Years

Variable	Variable Description	Project-Specific Change	Normalization
A	Aircraft Operations	No change	0.00
B	Aircraft Taxi/Idle/Delay	No change	0.00
C	Ground Access Vehicles	No change	0.00
D	Construction Equipment	75 pieces	1.50
		Total	1.50

Source: RoVolus, 2018.

Table 4-4. Airport "TUV" Aggregation Results —Operational Years

Variable	Variable Description	Project-Specific Change	Normalization
A	Aircraft Operations	+ 4,000 LTOs	0.29
B	Aircraft Taxi/Idle/Delay	No change	0.00
C	Ground Access Vehicles	+ 10,000,000 VMTs	0.40
D	Construction Equipment	No equipment	0.00
		Total	0.69

Source: RoVolus, 2018.

In this example, the aggregation for construction equipment is greater than 1.0, even though the operational aggregation is below 1.0. Therefore, the Federal Action exceeds the Screening Criteria for the construction period and an emissions inventory would be required.

4.4.2. Unmanned Aircraft System Screening

In order to assess the air quality impact of Federal Actions that facilitate hybrid and unmanned aircraft systems (UAS) being introduced into a specific air quality area, Screening Criteria have been evaluated that are intended to provide a rapid assessment of the impact of air emissions from such vehicles, and determine whether the additional resources associated with preparing an emission inventory is justified. A Screening Criteria was established using NO_x emissions factors for aircraft engines and the same emission rate increases used for the airport screening method described in **Section 4.4.1**. Much like the Screening Parameters for airport actions, the analysis was performed on a "worst case" scenario which in this case was emissions from an aircraft that

was placed in service prior to the introduction of emission standards. This screening assessment is limited to Federal Actions that are associated with the operation of UAS and the assessment is based on total fuel consumption resulting as a result of the Federal Action. If the Federal Action results in a total annual consumption increase of more than 1.4 million additional gallons (500,000 gallons in an OTR) of fuel per year, then an emissions inventory is recommended.

4.4.3. Air Traffic Screening

Federal Actions that result in air traffic changes can be screened for air quality impacts by using a simplified Screening Criteria that examines the emissions of criteria pollutants below the mixing height (nominally 3,000' above field elevation). This Screening Criteria was established using NO_x emissions factors for aircraft engines and the same emission rate increases used for the airport screening method described in **Section 4.4.1**. Much like the Screening Parameters for airport actions, the analysis was performed on a "worst case" scenario which in this case was emissions from this highest emitting aircraft contained in the AEDT model. This Screening Criteria is intended to provide the aviation environmental practitioner with the means to rapidly evaluate the impact of such air traffic actions and determine whether the additional resources associated with preparing an emissions inventory is justified. This screening assessment shows that if the Federal Action results in the total annual addition of more than 150,000 minutes of aircraft operation per year below the mixing height (60,000 minutes in an OTR) then an emissions inventory is recommended.

4.4.4. Documenting the Screening Evaluation

When the air emissions analysis of an attainment pollutant for a Federal Action is based on the Federal Action falling below the Screening Criteria, the FAA should ensure the analysis (and aggregation) is properly documented. The documentation should include at a minimum the responses to the Screening Criteria for each year considered and the supporting documentation used to answer the questions. In addition to the above documentation, the NEPA analysis can include a notation that "*The project parameters did not exceed the Screening Criteria and the project does not have the potential to cause significant air quality impacts.*" In the case that there is the possibility of significant impacts that would be better understood through further scientific analysis, nothing in this document precludes FAA from seeking a more comprehensive analysis.

4.5. If Federal Action exceeds Screening Criteria or was subject to General Conformity

The FAA's key obligation for any NEPA review is to assess potential environmental impacts and determine if they exceed a threshold of significance. The screening of air quality impacts for attainment pollutants is intended to identify projects that have minimal chance of adversely impacting ambient air quality and the potential for a significant impact; therefore allowing practitioners to quickly identify those Federal Actions that are unlikely to have significant air quality impacts and avoid unnecessary analysis. Please note that exceedance of the Screening Criteria is not by itself an indication the Federal Action will exceed the FAA's threshold of significance for air quality (see FAA Order 1050.1F, Exhibit 4-1). Rather, exceeding the Screening Criteria merely indicates that an emission inventory should be performed to determine the magnitude of the air quality impacts. It is also important to note that if the Federal Action's emissions of nonattainment pollutants have satisfied the General Conformity requirements it

inherently means that a Federal Action will not increase the frequency or severity of any NAAQS violations and the Federal Action will not delay attainment of the NAAQS. Thus, establishing that there will be no significant impacts to air quality from those pollutants.

4.5.1. Pollutant quantification for attainment pollutants when Screening Criteria is exceeded

When it is determined from the Screening Criteria that an emissions inventory is needed, two questions must be considered: (1) which pollutants need to be quantified, and (2) should both operational and construction emissions increases be quantified if only one exceeds the Screening Criteria?

The Screening Criteria has been established based on all criteria pollutants and associated precursors. Depending on emitting activity, CO, VOC, or NO_X were identified as control pollutants in prior research and the development of emissions models. In no cases were Pb, PM, or SO_X emissions expected to be greater than the emissions for the control pollutants. Regardless of this consideration, common emission models generally prepare emission inventories for all pollutants, except for Pb (these emissions are generally limited to piston-powered aircraft running on leaded aviation gasoline). Thus, it makes sense to disclose all the pollutants that are easily calculated by the models. The AEDT model must be used to quantify emissions associated with aircraft operations and delay. However, EPA's MOVES model would need to be used if quantifying emissions from ground access vehicles, construction equipment, or GSE. Popular modeling software (e.g. ACEIT) may have limited accuracy and only regulatory models approved in Appendix W of 40 CFR part 51 are suitable for regulatory actions. Instead, a federally developed emission model, approved in Appendix W of 40 CFR Part 51, should be used for quantification.

See the Appendix to this Handbook for guidance on addressing GHG emission inventories .

Given the limited control and opportunities for mitigation of Hazardous Air Pollutants (HAPs), and the lack of a threshold of significance for these pollutants, FAA does not require quantification of these emissions, and expects preparation of such an inventory to be uncommon.

4.5.2. Pollutant quantification for Federal Actions subject to General Conformity requirements

Analysis of nonattainment and maintenance pollutants for a Federal Action is performed pursuant to the General Conformity requirements. However, the General Conformity requirements only apply to the Proposed Action and No Action alternatives. Whereas NEPA requires disclosure of air quality impacts from all alternatives. As such, an emissions inventory needs to be prepared for any alternative in nonattainment and/or maintenance areas that has not been considered in the General Conformity analysis.

When there is an increase that exceeds the *de minimis* threshold in emissions of a non-reactive criteria pollutant, the General Conformity requirements often will call for dispersion modeling of those emissions[74] and that level of analysis would typically be appropriate for other NEPA

[74] 40 CFR 93.158 (a) (3)

alternatives being considered. Dispersion modeling is not expected to be appropriate for any other circumstances.

4.5.3. Emissions in Multiple Years

In an effort to balance the need for public disclosure against the need to prioritize limited resources, the FAA recognizes that there is a balance between quantifying every project year and simply quantifying the year of peak emissions.

This balance applies to Federal Actions where one of the Screening Criteria is exceeded, or the aggregate sum of the Screening Criteria is exceeded, and an emissions inventory needs to be prepared for a specific pollutant. Preparing additional years of emissions inventories may not provide additional information since many Federal Actions will only have a meaningful impact on emissions during construction, or one operational year can be representative of all operational years. In these cases, looking at all years would provide minimal benefit. Alternatively, limiting emissions quantification to the years where the Screening Criteria is exceeded would diminish disclosure of impacts and does not substantially reduce the burden of analysis. The incremental effort of preparing the quantification of an additional year is considerably less than the effort of preparing the initial analysis year.

In balancing these concerns, the FAA recommends that if the Screening Criteria is exceeded for construction emissions, the operational emissions outside of the construction period should be quantified if they are greater than $1/6^{th}$ of the screening threshold, i.e. 0.167. If operational emissions exceed the Screening Criteria, construction emissions should always be quantified for the year of peak emissions.

All aspects of Section 4.4 and 4.5 apply to an analysis for each criteria pollutant for each Federal Action (i.e. each Federal Action has six such analyses). However, it is recommended that if an emissions inventory is already being prepared for a criteria pollutant, FAA should consider documenting the emissions inventories for other criteria pollutants when no additional modeling is required to calculate those emission inventories.

5. Air Quality Assessment Models

This section identifies the various models and other supporting resources that are most often used by *Handbook* users for conducting aviation-related air quality analyses. These tools comprise computer models and databases that enable the users to compute emission inventories and conduct dispersion modeling for sources of air emissions that are typically encountered in FAA Federal Actions. Many of these models cover a broad array of sources, in addition to aviation sources, and the accuracy of the models is dependent on appropriate input data and information.

Table 5-1 (Emissions Inventory and Dispersion Models) identifies the most common regulatory air quality models available to *Handbook* users for conducting air quality analyses associated with aviation-related Federal Actions. It is important to note that only air quality models that have been approved by EPA and that are listed in Appendix W of 40 CFR 51 may be used for regulatory purposes (i.e., any FAA Federal Action). In many analyses, more than one model may be used. There are other models not listed in Table 5-1 that may be applicable and appropriate for use in specialized situations depending on circumstances associated with a project. Practitioners seeking approval for the use of a regulatory model that is not listed in Table 5-1 should contact AEE-300 for guidance. The air quality analyses performed by these models include emissions inventories for both airport operations and construction as well as airport and roadway dispersion modeling. These models are further detailed within this section.

If multiple regulatory models are used to determine impacts from different aspects of a Federal Action, care must be taken to ensure that the results are accurately compiled and reflect the total impact of a Federal Action. This *Handbook* attempts to avoid reference to specific versions of a model (unless describing historical evolution) because these models are frequently updated.

Table 5-1. Emissions Inventory and Dispersion Models

Models	Emissions Inventories				Airport Dispersion Modeling for Criteria Pollutants
	Airport Operation	Airport Construction	GHG[1]	HAPs	
AEDT	✓		✓	✓	✓
MOVES/NONROAD	✓	✓	✓	✓	
AERMOD (as part of AEDT)					✓
EMFAC/OFFROAD[2]		✓	✓	✓	

Source: EPA, *Air Quality Models*, https://www.epa.gov/scram/air-quality-models;), https://www.faa.gov/air_traffic/environmental_issues/Environmental_TETAM/, and Aviation Environmental Design Tool (AEDT), https://aedt.faa.gov/; and EPA's, *MOVES (Motor Vehicle Emission Simulator)*, https://epa.gov/moves, *NONROAD Model*, https://www.epa.gov/moves/nonroad-technical-reports, *AERMOD Modeling System*, https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models, and *CAL3QHC/CAL3QHCR Models*, https://www.epa.gov/scram/air-quality-dispersion-modeling-alternative-models.

[1] AEDT estimates emissions of CO_2 and MOVES estimates emissions of CO_2, N_2O, and CH_4.

[2] EMFAC/OFFROAD models are the EPA-required models for use in California only in lieu of MOVES/NONROAD.

5.1. Aviation Environmental Design Tool

The Aviation Environmental Design Tool (AEDT) is developed and distributed by the FAA Office of Environment and Energy (AEE).[75] Essential and up-to-date information regarding AEDT as well as links to AEDT documentation and FAA guidance can be obtained on the official website for AEDT.[76]

AEDT is a software system that dynamically models aircraft performance to compute emissions, fuel burn, and noise and assess their interdependencies. AEDT has the capability to conduct "full-flight" or "gate-to-gate" analyses at a single airport or a "metroplex,"[77] and further assess these facilities and operations at regional, nation-wide, and global levels.

5.1.1. AEDT Development and Architecture

In 2012, AEDT version 2a (i.e., AEDT 2a) replaced the "legacy" regional noise analysis tool, the Noise Integrated Routing System (NIRS).[78] The primary purpose of AEDT 2a was to model the environmental consequences of airspace and procedure actions being designed and implemented by the FAA's Air Traffic Organization (ATO). AEDT 2a also included the capability to assess CO_2 emissions from aircraft main engines.

In 2015, AEDT version 2b replaced AEDT 2a and the legacy airport air quality and noise analysis tools - the EDMS and the Integrated Noise Model (INM). AEDT2b then became the FAA's single environmental assessment tool for air quality and noise impacts from aircraft for all Federal Actions, including but not limited to airport and airspace NEPA reviews, General Conformity determinations, Master Planning studies, and Part 150 Noise Compatibility Programs.

The AEDT user interface and underlying software architecture are distinct from that of the EDMS and INM models. AEDT is built on the Microsoft .NET Framework and is capable of running on Microsoft Windows desktop and server operating systems. It is supported by an extensive system of relational databases and an ESRI[79] geospatial capability. Input data are entered into AEDT using the user interface, an XML-based AEDT Standard Input File (ASIF), and/or other EDMS/INM model import tools.[80]

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75 FAA, Aviation Environmental Design Tool (AEDT), http://www.faa.gov/about/office_org/headquarters_offices/apl/research/models/aedt/

76 FAA, *AEDT Support Website*, https://aedt.faa.gov/.

77 A Metroplex is a geographic area covering several airports, serving major metropolitan areas and a diversity of aviation stakeholders.

78 FAA, *Guidance on Using AEDT 2a to Conduct Environmental Modeling for FAA Air Traffic Airspace and Procedure Actions*, March 2012, http://www.faa.gov/air_traffic/environmental_issues/media/Memo-AEE-400_GuidncMem4_UsingAEDT2a_EnviroModeling_21MAR2012.pdf.

79 ESRI's GIS (geographic information systems) mapping software enables the visualization of geographic data, http://www.esri.com/.

80 FAA, *AEDT Support Website*, https://aedt.faa.gov/.

5.1.2. AEDT Usage for Air Quality Assessments

Using AEDT, aviation-related emissions inventories can be computed for five of the criteria pollutants (CO, NO_2, PM_{10}, $PM_{2.5}$, and SO_2), ozone precursors (NO_x and VOCs), and lead via the calculation of avgas consumption.[81] Sources of aviation-related emissions included in AEDT encompass aircraft, APUs, GSE, and an array of stationary sources (e.g., boilers, generators, etc.). Motor vehicle emissions must be computed through use of the EPA's Motor Vehicle Emission Simulator (MOVES)[82] model independently of AEDT.

Dispersion modeling can also be conducted within the AEDT interface, based on the results of the emissions inventory and supplemented with meteorological data and the definition of receptor sets. Once the necessary data are entered into AEDT, AEDT internally invokes the EPA AERMOD modeling system to perform the specified dispersion calculations. The resulting concentrations are displayed in the AEDT interface via maps of receptor sets and as tabular output.

5.2. MOVES/NONROAD

The Motor Vehicle Emissions Simulator (MOVES) is the emission modeling system developed by the EPA's Office of Transportation and Air Quality (OTAQ) that estimates emissions for mobile sources, but not including aircraft.[83] Currently MOVES provides emissions for on-road vehicles including cars, trucks, motorcycles, and buses and estimates exhaust and evaporative emissions as well as brake and tire wear emissions from all types of on-road vehicles for any part of the country, except California.

The EPA officially released the MOVES3 model in January 2021 which is an enhancement from previous on-road MOBILE emissions model (MOBILE6.2). Presently, MOVES incorporates numerous new features and a number of performance improvements over the original version, including the capability to compute non-road vehicle emissions. Compared to the previous MOBILE model, MOVES incorporates the latest emissions data, more sophisticated calculation algorithms, increased user flexibility, new software design, and other significant capabilities. Notably, California requires the use of its own motor vehicle emissions model known as EMFAC2017 (see **Section 5.4**).[84]

MOVES requires various inputs (e.g., vehicle population, vehicle age distribution, vehicle miles travelled [VMT], etc.) and depending on the geographical scale (i.e., national, county, or local) of the assessment, default values may not be appropriate to use. In these cases, state and regional air quality regulatory and transportation planning agencies should be consulted, as these agencies might have more area-specific data. MOVES produces emission factors in grams of pollutant per vehicle mile or grams per idle minute by hour of day or season.

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[81] National Academies of Science, Transportation Research Board Special Report 336, *Options for Reducing Lead Emissions from Piston-Engine Aircraft (2021).*

[82] EPA, *MOVES (Motor Vehicle Emission Simulator)*, https://epa.gov/moves.

[83] EPA Memorandum Feb 8, 2011: *Using the MOVES and EMFAC Emissions Models in NEPA Evaluations*, https://www.epa.gov/sites/default/files/2014-08/documents/using-the-moves-and-emfac-emissions-models-in-nepa-evaluations-pg.pdf.

[84] CARB, *Mobile Source Emission Inventory -- Current Methods and Data*, http://www.arb.ca.gov/msei/modeling.htm.

The EPA offers several guidance documents on the MOVES model that may be useful to the users of this *Handbook*.[85,86,87,88,89]

NONROAD is a computerized database developed by the EPA to provide state, local, and tribal air quality agencies with the ability to create and forecast emission inventories for certain nonroad categories of emission sources, such as agricultural and construction equipment, all-terrain recreational vehicles, marine equipment, lawn and garden equipment, and a variety of other off-road vehicles and equipment.[90] NONROAD does not address aircraft. This model is available both integrated into the MOVES model and as a standalone model. The required inputs vary by the type of vehicle/equipment for which emissions estimates are sought. For airport applications, NONROAD is used primarily for the estimation of emissions from GSE and construction-related equipment. The EPA offers additional guidance documents on the NONROAD model that may be useful to the users of this *Handbook*.[91,92]

5.2.1. ACEIT

The Airport Construction Emissions Inventory Tool (ACEIT) is a software tool developed by the Transportation Research Board (TRB) to bring consistency to airport construction emissions inventories and to allow users to better understand and quantify airport construction emissions. ACEIT enables users to rely upon default information about the construction process for typical airport Federal Actions. The ACEIT Guidebook provides information to enhance user understanding of the construction process and information needed to improve the quality of emissions inventories developed by using default settings and data in the tool. Guidance on the tool and ACEIT Guidebook is maintained on the TRB website.[93] ACEIT is based on emission factors calculated by NONROAD, and at the time of preparing this *Handbook* has not been updated with MOVES emission factors. Absent MOVES emission factors, this tool does not meet EPA

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85 EPA, *Policy Guidance on the Use ofMOVES3 for State Implementation Plan Development, Transportation Conformity, General Conformity, and Other Purposes,* November 2020 [EPA-420-B-20-044] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010LXH.pdf.

86 EPA, MOVES3 Technical Guidance: *Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity*, November 2020 [EPA-420-B-20-052] https://www.epa.gov/sites/default/files/2020-11/documents/420b20052.pdf .

87 EPA, *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Non-attainment and Maintenance Areas*, October 2021 [EPA-420-B-21-037], https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013C6A.pdf.

88 EPA, *Using MOVES in Project-Level Carbon Monoxide Analyses,* December 2010 [EPA-420-B-21-047], https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013NP8.pdf.

89 EPA, *Using MOVES for Estimating State and Local Inventories of On-Road Greenhouse Gas Emissions and Energy Consumption*, June 2016 [EPA-420-B-16-059], https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100OW0B.pdf.

90 EPA, *NONROAD Model*, https://www.epa.gov/moves/nonroad-technical-reports.

91 EPA, *Public Data on Gasoline Fuel Quality Properties*, 1999-2020 https://www.epa.gov/fuels-registration-reporting-and-compliance-help/public-data-gasoline-fuel-quality-properties.

92 EPA, *Nonroad Technical Reports*, https://www.epa.gov/moves/nonroad-technical-reports

93 ACRP 02-33 [Final], *Guidance for Estimating Airport Construction Emissions*, *https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3034*

criteria of using emission models approved in Appendix W of 40 CFR Part 51. Any use of the ACEIT model should be limited to facilitating understanding of equipment usage relative to project characteristics. Consequently, any use of ACEIT is permissible only if such use is required by the State and/or local air quality agency. State/local air quality agency requirement of the use of ACEIT must be in writing.

5.3. AERMOD

Developed by the EPA, AERMOD is an atmospheric dispersion model which can simulate point, area, volume, and line sources of emissions and has the capability to include simple, intermediate, and complex terrains.[94,95] It also predicts both short-term (1 to 24 hours) and long-term (quarterly or annual) average concentrations. The model can be executed by using the regulatory default options (e.g., stack-tip downwash, elevated terrain effects, calm wind speeds processing routine, missing data processing routine, buoyancy-induced dispersion, and final plume rise), default wind speed profile categories, default potential temperature gradients, and pollutant decay. Lastly, AERMOD has the capability to account for building downwash effects and to employ gas or particle deposition or wet/dry depletion of the plume. AERMOD is commonly executed to yield 1-hour and season average concentrations (in $\mu g/m^3$) at each receptor. These concentrations may be presented as plot files or receptor files showing the results at each receptor for tabular and graphical display.

For a detailed discussion on AERMOD and dispersion modeling refer to **Section 7.1** *(Atmospheric* Dispersion *Modeling)* and **Appendix W of 40 CFR 51**. AERMOD model has been integrated into AEDT, but when modeling non-aircraft sources, can be run independent of AEDT.

5.4. EMFAC & OFFROAD

The EMFAC emissions model is developed and used by the California Air Resources Board (CARB) to assess emissions from on-road vehicles including cars, trucks, and buses in California, and to support CARB's regulatory and air quality planning efforts. USEPA has approved EMFAC for use in State Implementation Plan and transportation conformity analyses[96]. CARB has also released the OFFROAD model which calculates emissions from off-road sources of airport construction equipment and GSE for projects in California. However, the OFFROAD model is now being replaced by category specific methods and inventory models that are being developed for specific regulatory support projects. If a category is not listed, OFFROAD2007 is the current model for estimating emissions for such category. A comprehensive web query tool, OFFROAD2021 is available to access the most recent model outputs from all offroad categories.

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[94] EPA Preferred/Recommended Models, *AERMOD Modeling System*, https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models.

[95] Title 40 CFR Part 51, *Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule,* November 2005, https://www.federalregister.gov/documents/2005/11/09/05-21627/revision-to-the-guideline-on-air-quality-models-adoption-of-a-preferred-general-purpose-flat-and.

[96] *Official Release of EMFAC2017 Motor Vehicle Emission Factor Model for Use in the State of California*, 84 FR 41717 (August 15, 2019).

6. Quantifying Emissions

This section addresses the preparation of emissions inventories for three separate categories of emissions: (i) criteria pollutants, (ii) hazardous air pollutants, and (iii) greenhouse gases.

6.1. Criteria Pollutants

6.1.1. Introduction & Background

The purpose of this section is to identify and provide guidance on the various methods that are available to Handbook users for assessing air quality conditions associated with aviation-related Federal Actions. This section focuses on computing criteria pollutant emissions inventories resulting from operational and construction activities for the aviation sector.

6.1.2. Existing Guidance

The guidance documents listed in **Table 6-1** (*Historical Guidance on Criteria Pollutant Emissions Inventory Preparation*) reflect the historical development of the computation methodologies for criteria pollutant emissions arising from an airport's operations, as well as from construction activities undertaken to improve airport facilities/operations. Details specific to an emissions source or sources are provided for each listed guidance document.

Table 6-1. Historical Guidance on Criteria Pollutant Emissions Inventory Preparation

Guidance Document	Emissions Source(s)	Description
EPA, *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*, December 1992, [EPA-420-R-92-009]	Aircraft	Provides a framework for how aircraft fleet and activity levels are obtained, as well as a methodology for computing emissions based on static parameters (i.e., not based on flight performance). The method is adjustable to account for local conditions (i.e., the local mixing height) and allows for the application of either aircraft-specific or fleet average emission factors.
	GSE/Construction Equipment	GSE and construction equipment are treated identically in terms of emissions calculation methodology, whereby an inventory is generated using equipment population, annual operating hours, rated horsepower, equipment load factor and emissions factors.
	Ground Access Vehicles	Focuses on inventories of motor vehicle activity for entire fleets over a large geographic domain, is based on fleet-wide vehicle miles of travel, and calls for the definition of local parameters such as emissions control programs and fuel specifications.

Guidance Document	Emissions Source(s)	Description
EPA, *Documentation for Aircraft Component of the National Emissions Inventory Methodology*, January 2011	Aircraft	Advocates the use of EDMS combined with airport-specific LTO data to compute aircraft emissions inventories from commercial operations, retaining EDMS "default" information (e.g., taxi times) in many respects. Also provides an alternate methodology based on "composite" emissions factors and more generalized operational data when airport-specific information is not readily available, calling only for the level of piston and jet LTOs and the segregation of these operations between the air taxi and general aviation categories. Of note, this methodology is not used by FAA practitioners for NEPA.
	GSE/APU	For commercial aircraft operations only, the guidance applies EDMS default parameters to estimate emissions from GSE and APU.
EPA, *Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory,* December 2010, [EPA-420-B-10-044]	Aircraft	Provides a methodology to estimate lead emissions arising from the combustion of leaded avgas, relying upon the level of piston-engine LTOs, lead content of avgas, and the level of lead retention in an engine during typical operation.
FAA & EPA, *Technical Data to Support FAA's Advisory Circular on Reducing Emissions from Commercial Aviation*, September 29, 1995	Aircraft, GSE, APU	Outlines calculation methods to estimate emissions from GSE and APU utilization on commercial service aircraft and provides example data parameters and activity inputs to this purpose. Also identifies some considerations related to assessing emissions reduction potential for commercial aircraft, GSE and APU.
FAA, *Aviation Environmental Design Tool (AEDT) Technical Manual,* version 3e May 2022	Aircraft	This document provides quantification methodologies for aviation related emissions and how inventories should be input to the AEDT program.
FAA, *Use of First Order Approximation (FOA) to Estimate Aircraft Engine Particulate Matter (PM) Emissions in NEPA Documents and Clean Air Act General Conformity Analyses*, May 2005	Aircraft	Consistent with methods outlined by the ICAO, this document identifies how both volatile (i.e., fuel sulfate, fuel organic, and lubrication oil organic compounds) and nonvolatile (i.e., soot) PM emissions are quantified from aircraft engines. An updated FOA is currently implemented in AEDT and described in the *AEDT Technical Manual.*
EPA, AP-42, Fifth Edition, *Compilation of Air Pollutant Emission Factors*, *Volume I: Stationary Point and Area Sources,*1995	Stationary Sources, Construction Activities	Emission factor source and methodological guide for combustion and non-combustion stationary source emissions handled by AEDT. Also serves as a guide to compute non-exhaust emissions from construction activities such as land disturbance, demolition, travel on unpaved roads, materials handling, and other activities undertaken during the construction period.

Guidance Document	Emissions Source(s)	Description
Jagielski, Kurt D., and Robert J O'Brien, *Calculation Methods for Criteria Air Pollutant Emission Inventories*, July 1994	Stationary Sources	Provides equivalent/alternative methods and data to AP-42 for the computation of emissions from select stationary sources including generators, engine testing and coating operations.
EPA, *Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a and 2010b*, April 2012, [EPA-420-B-12-028]	Ground Access Vehicles	Guides a user through the technical aspects of developing, modifying and/or using county-level or larger series of MOVES inputs for emissions calculations, such as inspection/maintenance programs, fuel supply and formulation, and vehicle age distributions.
EPA, *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*, November 2013, [EPA-420-B-13-053]	Ground Access Vehicles	Guides a user through the project-level components of an emissions analysis of PM_{10} and/or $PM_{2.5}$, such as defining roadway links, link activity, and how to assess and utilize meteorological data for developing emissions rates. This guidance also forms the basis of roadway intersection analyses discussed in **Section 7.2** (*Roadway Dispersion Modeling*).
EPA, *Using MOVES in Project-Level Carbon Monoxide Analyses*, December 2010, [EPA-420-B-10-041]	Ground Access Vehicles	Guides a user through the project-level components of an emissions analysis of CO, such as defining roadway links, link activity, and how to assess and utilize meteorological data for developing emissions rates. This guidance also forms the basis of roadway intersection analyses discussed in **Section 7.2** (*Roadway Dispersion Modeling*).

6.1.3. Airport Operations

6.1.3.1. Airport Operation Emission Inventory Methods

Typical sources and activities addressed in a criteria pollutant emissions inventory of airport operations include aircraft, APU, GSE, stationary sources, and ground access vehicle operations. In general terms, a criteria pollutant emissions inventory is computed by combining pollutant emissions factors with source activity levels; for instance, GSE emissions factors are expressed in pounds of pollutant per horsepower-hour of operation, and are applied to a given GSE's known horsepower and operating schedule.

Building on the foundations laid by the documents and methods referenced in **Table 6-1,** *Historical Guidance on Criteria Pollutant Emissions Inventory Preparation*, this section discusses considerations for preparing a criteria pollutant emissions inventory for airport operations, including how the source(s) activity is typically characterized as well as how applicable emissions model(s) such as AEDT apply emissions factors or otherwise translate that activity into an emissions estimate. Construction emissions are addressed separately in **Section 6.1.4** (*Airport Construction Emissions*). For additional information on how to populate AEDT to compute aircraft, GSE, and APU emissions, please refer to the *AEDT Technical Manual*.

Aircraft

Fixed wing aircraft emissions for a criteria pollutant emissions inventory are computed in AEDT by factoring total aircraft operational activity against a database of aircraft/engine-specific emission factors based on engine manufacturer, model, and aircraft operational mode within the landing and takeoff (LTO) cycle. For the purposes of emissions inventory, an LTO cycle consists of the following operational modes:

- *Approach*: The airborne segment of an aircraft's arrival extending from the start of the flight profile (or the mixing height) to touchdown on the runway;
- *Taxi In*: The landing ground roll segment (from touchdown to the runway exit) of an arriving aircraft, including reverse thrust, and the taxiing from the runway exit to a gate;
- *Startup*: Aircraft main engine startup (for VOC only) occurs at the gate and is considered in AEDT for ICAO certified engines only;
- *Taxi Out*: The taxiing from the gate to a runway end;
- *Takeoff*: The portion from the start of the ground roll on the runway, through wheels off, and the airborne portion of the ascent up to engine cutback during which the aircraft operates at maximum thrust; and
- *Climb Out*: The portion from engine cutback to the end of the flight profile or the mixing height.

AEDT calculation of emissions within the LTO relies on two main categories of input: (i) aircraft fleet and operations, and (ii) time within each mode of the LTO cycle.

Aircraft Fleet and Operations

At a minimum, AEDT requires that an aircraft fleet (i.e., the types of aircraft using the airport and their assigned engines) be defined and a level of operations (i.e., either arrivals/departures/touch-and-gos, or LTO) be assigned to each member of the aircraft fleet. AEDT can accept varying levels of detail depending on the extent to which aircraft operational parameters at a given airport are available or known. These range from the selection of a generic aircraft fleet with "default" engines selected by AEDT, to the identification of specific airframes and engines based on an air carrier's market information, to the modeling of individual flights based on flight schedules or radar data. Typical sources of data that can be used to identify and define these parameters are described in the *AEDT Technical Manual*.

Aircraft LTO Cycle Emissions

AEDT calculates emissions for the takeoff, approach, and climb out (i.e., the aloft) components of the LTO cycle, based on aircraft flight profiles, characteristics of individual aircraft, and meteorological conditions. Users are able to select from a series of profiles that reflect different aircraft takeoff weights and takeoff power settings, or they can define custom profiles. In addition, local meteorological data can be used. This allows for a more site-specific characterization of emissions aloft. Fuel consumption and emissions can be modeled for the full flight in AEDT, though only those emissions released below the atmospheric mixing height are typically considered for a local air quality analysis. The mixing height is defined as the height of the atmosphere where relatively vigorous mixing of pollutants and other gases takes place. Directly

above the mixing height, the atmosphere is fairly stable and there is limited vertical dispersion of polluted air. The mixing height varies both diurnally and seasonally. For an emissions inventory, the user specifies the average mixing height to be used by AEDT. For a dispersion analysis, the mixing height is calculated automatically based on the hourly meteorological data that has been provided.

For aircraft emissions on the ground, the user can specify fixed taxi in and taxi out times by airport average or by flight operation; but this is the lowest level of fidelity for modeling such emissions. Using fixed times does not capture airport-specific operating parameters such as ground delay, airfield configuration, ramp locations, variation in aircraft speed, and other important factors. AEDT provides a higher-fidelity taxi modeling option. Users can define operational profiles that reflect how the taxi times vary by quarter hour, day of the week, and month of the year in order to reflect the regular temporal variability in taxi operations. AEDT also allows the user to define paths to be used from gates to runway ends. Once this taxi network has been built, AEDT can apply its delay and sequencing model to estimate the amount of time required for the aircraft to taxi to and from the gate, accounting for the amount of traffic also operating on that part of the airport.

Ground Support Equipment (GSE)

GSE criteria pollutant emissions inventories using AEDT captures two distinct sets of GSE utilization at an airport: (i) GSE servicing gated aircraft on the apron, and (ii) other activities of the GSE population not tied to gate service operations. An example of a gate service operation is a baggage tractor visiting an aircraft at the apron to drop off baggage; an example of a population activity is a deicing truck driving back and forth to a deicing area during the deicing season.

To compute GSE emissions, AEDT applies emissions factors (in grams per horsepower hour [g/hp-hr]) specific to the make/model, year of manufacture, approximate horsepower, and fuel type of a given equipment to annual hours of operation for that equipment. These emissions calculations are further adjusted using the observed horsepower of the equipment and the equipment's average percentage of full throttle (i.e., load factor). AEDT offers "default" values for many of these parameters. AEDT also affords a user the choice to override them in the case that comprehensive information on an airport's GSE fleet is known.

For GSE population activities, users need only specify the make/model, model year, horsepower, fuel type, and annual hours of operation for a given piece of equipment (or accept AEDT's default information). This approach also applies to the gate service GSE. However, AEDT computes annual hours of operation for gate service GSE by considering the number of aircraft LTOs for which GSE service is provided and the total running time of the GSE per LTO.

Calculation steps and input data necessary to compute GSE emissions in AEDT are further explained in **FAA's *Aviation Environmental Design Tool (AEDT) Technical Manual***.

Auxiliary Power Units (APUs)

AEDT automatically assigns most large commercial and cargo aircraft a representative make and model of APU, if agency/industry documentation indicates that an APU is used on that aircraft.[97] Annual APU emissions are a function of the number of LTOs performed by the equipped aircraft, the time the assigned APU operates per LTO, and the emissions factors assigned to the APU. When assigning APU operating times per LTO, infrastructure considerations such as the availability of fixed electrical ground power and pre-conditioned air, as well as meteorological conditions such as the annual temperature in the area, should be considered as these variables factor into the frequency and duration with which an APU is operated.

Stationary Sources

Currently, AEDT can estimate criteria pollutant emissions from the following stationary sources of air emissions, categorized based on whether the emissions occur from fuel combustion or from passive, non-combustion processes such as evaporation or erosion:

- *Combustion Sources* - Boilers and heaters, generators, snowmelters, incinerators, fire training facilities, and aircraft engine testing; and
- *Non-Combustion Sources* - Fuel storage tanks, cooling towers, coating and painting operations, de-icing and anti-icing operations, solvent degreasing, and salt and sand piles.

For combustion-related stationary sources, activity levels in the form of an operating schedule (e.g., annual hours of operation) or a mass of fuel consumed (e.g., annual cubic feet of natural gas) are factored against appropriate emissions factors to derive an emissions inventory. For non-combustion sources, the activity levels required for an emissions calculation relate to a number of factors including (but not limited to) the level of material or fuel moved through or stored within the device, the dimensions and size of the device, and the application area over which a substance is applied.

EPA's *AP-42 Compilation of Air Emission Factors* contains detailed data input requirements and calculation steps used to compute emissions from all of the combustion and non-combustion stationary sources identified in this section.

Ground Access Vehicles

Motor vehicle criteria pollutant emissions inventories typically focus on three distinct types of activities: (i) vehicles traversing airport roadways; (ii) vehicles accessing parking facilities; and (iii) vehicles accessing the terminal curbside areas for passenger pickup and drop-off.

The EPA's Motor Vehicle Emissions Simulator (MOVES) is the current federally-approved tool to compute motor vehicle emissions rates representative of the types of activities specified above. Using locally developed data on vehicle types, fuel types, vehicle ages, inspection and maintenance programs, and other factors, MOVES will generate emissions rates in grams of pollutant per vehicle mile of travel (g/VMT) or grams per vehicle hour of operation (g/hour)

[97] FAA & EPA, *Technical Data to Support FAA's Advisory Circular on Reducing Emissions from Commercial Aviation,* September 29, 1995, http://libraryarchives.metro.net/DPGTL/epa/1995-technical-data-to-support-faa-advisory-circular-on-reducing-emissions-from-commercial-aviation-draft.pdf.

against which airport motor vehicle activities can be applied. See EPA's latest MOVES User Guide for further details on how best to use MOVES for specific applications.[98]

In order to use MOVES emission rate information to estimate roadway emissions, the VMT must first be calculated for each type of vehicle, and those VMTs must be apportioned for each speed that the vehicle operates at (e.g., separate VMT for all passenger cars, all diesel shuttles, CNG buses, etc.). These calculations will be a function of the traffic volumes for a given type of vehicle, the road segment speed, and the length of the roadway segment. The total VMTs for each vehicle type can be quantified based on either traffic counts and fleet mix assumptions or planning assumptions. By factoring a vehicle type's VMT against its corresponding emissions factor in g/VMT, a total mass of pollutant is obtained.

Travel-based VMT that is computed for parking and curbside activities is converted to a total mass of pollutant(s). However, a considerable portion of the motor vehicle emissions attributable to parking and curbside activities are caused by vehicle idling. So, in addition to computing a VMT for the parking and curbside areas when a vehicle is in motion, an emissions inventory also derives or estimates the total number of hours spent at idling for each vehicle type and for each parking facility/curbside area, and apply the appropriate g/hour emissions rate to produce a total mass of pollutant. By summing the travel emissions based on VMT and the idling emissions based on hours of operation, a total emissions inventory of roadway, parking and curbside motor vehicle activities is obtained.

6.1.3.2. Airport Operation Emissions Inventory Results

Once the assessment is complete, an operational criteria pollutant emissions inventory is typically documented using the example template shown in **Table 6-2**, *Operational Emissions Inventory Results*, which summarizes the total emissions, in tons of pollutant per year of operation,[99] by emissions source. This example also highlights how emissions should be summarized in FAA NEPA documents to compare the proposed action alternatives against the No Action alternative and assess the level of emissions increase (or decrease) that would occur. Refer to **Section 8** (*Conformity*) for details on how to relate this emissions increase (or decrease) to CAA analysis.

Table 6-2. Operational Emissions Inventory Results

Source	Proposed Action (short tons/year)					
	CO	VOC	NO_x	SO_x	PM_{10}	$PM_{2.5}$
Aircraft	718	146	482	59.7	7.3	7.3
APUs	22.8	1.6	12.7	2.2	2.2	2.2
GSE	81.8	6.3	51.0	0.4	5.9	5.7
Stationary Sources	3.6	0.2	4.5	0.1	5.9	5.7
Motor Vehicles	261	6.2	35.1	0.8	2.6	1.2
Total Proposed Action	**1,087**	**160**	**585**	**63.1**	**78.2**	**76.6**
Total No Action	**1,018**	**154**	**536**	**58.9**	**76.6**	**75.3**
Net Increase (project-related)	**69**	**6**	**49**	**4.2**	**1.6**	**1.3**

[98] "Using MOVES with AEDT" provides guidance on this topic - https://aedt.faa.gov/3d_information.aspx.

[99] For conformity analyses the various inventories (i.e., operations, construction) need to be converted into tons per year.

6.1.4. Airport Construction Emissions

Although comparatively short-term in duration, construction-related air emissions can have an impact on both local air quality conditions and on the regional airshed. Moreover, construction emissions are classified as "direct" sources of emissions under the CAA General Conformity rule (see **Section 8**, *Conformity*). As a result, these emissions must be quantified, and in some cases mitigated, in nonattainment/maintenance areas in order to meet the requirements of the General Conformity rule. In attainment areas, construction-related emissions are evaluated following the flow chart in **Section 4** for disclosure purposes only under NEPA.

This section provides recommended approaches for assessing construction emissions associated with FAA Federal Actions. EPA's MOVES2014a Users Guide (Construction Emission Inventory for Criteria Pollutants) provides additional information on these emissions including emissions inventory methods and equations, data sources and other supporting materials.

6.1.4.1. Construction Emissions Inventory Methods

Construction-related emissions are primarily associated with the exhaust from heavy equipment (e.g., backhoes, bulldozers, graders, etc.), delivery trucks (e.g., cement trucks, dump trucks, etc.), and construction worker vehicles traveling to, from, and moving around the site, as well as fugitive dust from site preparation, land clearing, material handling, and demolition activities. Construction emissions are also produced by the storage/transportation of raw materials, the disposal of construction debris and the production of asphalt or concrete. These emissions are temporary in nature (i.e., during the construction period only) and generally confined to the construction site and the access/egress roadways. Other types of fugitive emissions (e.g., asphalt off-gassing, etc.) occur in construction but are relatively insignificant and included on a case-by-case basis.

Typically, emissions from construction activities are estimated based on the construction activity schedule for the Federal Action, the number and types of vehicles/pieces of equipment needed, the types of fuel used, and the vehicle/equipment utilization rates.

Emission factors for on-road vehicles (e.g., passenger cars, pickup trucks, haul trucks, etc.) can be obtained from the EPA MOVES[100] emissions model or the California OFFROAD emissions model (for projects in California). The emission factors should be developed in accordance with appropriate state, local, or tribal regulatory guidelines. For on-road vehicles, the anticipated VMT should be determined or estimated to compute emissions.

Emission factors for off-road equipment (e.g., dump trucks, dozers, graders, etc.) can also be obtained from the EPA MOVES emissions model or the California OFFROAD emissions model (for projects in California). For off-road equipment, the expected equipment size, hours of operation, and load factors are required or need to be estimated.

An alternative approach when precision is not required is to use the- ACEIT emission estimating tool (see description of limitations in **Section 5.2.1**). This model takes input on project size and type of product to calculate criteria pollutant emissions. The simplicity of the model inputs affects the accuracy of the calculation, but for circumstances where the quantification demonstrates that the emissions are not anywhere close to a regulatory threshold, the results can be sufficient. It is

[100] EPA, *Motor Vehicle Emissions Simulator (MOVES)*, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

recommended that use of such an alternative approach be discussed with state, local, or tribal air quality offices before being used.

Fugitive dust emissions can be computed from emission factors contained within EPA's *Compilation of Air Pollution Emission Factors* (i.e., AP-42).[101] These factors are combined with project-specific values representing areas of disturbance, volumes of materials processed and/or dust control measure efficiencies.

6.1.4.2. Construction Emissions Inventory Results

For consistency with the operational emissions inventory and for direct comparison to the General Conformity *de minimis* levels, construction emissions inventory results should also be reported in tons per year. **Table 6-3** (*Construction Emissions Inventory Results)* provides a sample format for reporting these emissions. For simplification, total values are shown for each pollutant, construction year and alternative evaluated.

[101] EPA, *Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors*, https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors.

Table 6-3. Construction Emissions Inventory Results

Alternative	Pollutant	Construction Year (tons per year)			
		Year 1	Year 2	Year 3	Year 4
Alternative A	**CO**	1.08	15.9	11.4	12.2
Alternative B		1.23	12.6	20.1	22.2
Alternative A	**VOC**	0.23	3.02	2.28	2.39
Alternative B		0.26	2.49	4.01	4.48
Alternative A	**NO_x**	1.31	28.7	19.5	21.5
Alternative B		1.66	21.5	35.8	38.8
Alternative A	**SO_x**	0.03	0.64	0.44	0.49
Alternative B		0.04	0.48	0.82	0.90
Alternative A	**PM_{10}**	0.17	2.45	1.79	1.91
Alternative B		0.19	1.97	3.19	3.56
Alternative A	**$PM_{2.5}$**	0.17	2.38	1.73	1.86
Alternative B		0.19	1.91	3.09	3.45

6.2. Hazardous Air Pollutants

Hazardous air pollutants (HAPs) are pollutants for which there are no NAAQS, but are still regulated under the federal CAA because of their potentially adverse effects on human health and the environment. There is no regulatory requirement for FAA to prepare an emissions inventory of HAPs, but FAA may decide to prepare such an inventory when there is significant public interest in this issue. Also known as "air toxics," these pollutants are comprised of a wide array of organic and inorganic compounds (e.g., formaldehyde, diesel particulate matter, acetaldehyde, benzene, toluene, acrolein, 1,3-Butadiene, xylene, lead, naphthalene, propionaldehyde). Such emissions are present as trace components in the exhaust of aircraft, GSE/APUs, and motor vehicle engines and, to a lesser extent, from boilers, fuel facilities, and other stationary sources. **Section 3** (*Sources and Types of Emissions*) identifies and generally describes these emissions as they pertain to aviation.

This section addresses the available approaches for assessing HAPs in connection with FAA Federal Actions. The AEDT model is the preferred tool for creating HAPs emission inventories.

6.2.1. Introduction & Background

The EPA has identified 188 air pollutants[102] that are considered to be HAPs and therefore subject to the requirements of Section 112 (*Hazardous Air Pollutants*)[103] of the CAA. From this list of 188

[102] 42 U.S.C. § 7412(b)(1); 40 CFR 63.64.

[103] 42 U.S.C. § 7412; *see also* EPA, *Introduction to CAA and Section 112 (Air Toxics)*, https://www.epa.gov/laws-regulations/summary-clean-air-act.

HAPs, 33 have been further designated by the EPA as having the greatest potential health threat to the general public in the largest number of urban areas and are known as "Section 112(k) HAPs."[104] The major categories of HAPs in this group include volatile and semi-volatile organic compounds (i.e., VOCs, SVOCs) and heavy metals.

In a related matter, the EPA has identified 21 HAPs that are designated as Mobile Source Air Toxics (MSATs)[105] to signify those HAPs that are emitted by motor vehicles and non-road engines (e.g., farm and construction equipment, heavy industrial vehicles, GSE, etc.). These pollutants include VOCs and heavy metals that are commonly associated with the combustion of gasoline and diesel fuels - including those emitted by aviation-related motor vehicles and GSE.

Other sources of HAPs associated with airports are similarly regulated under Section 112 of the CAA if their emissions exceed established thresholds and they meet the definition of a major stationary or area source. These may include aircraft repair and maintenance facilities, engine test cells, central heating plants, painting operations, and other airport support services that generate air emissions.

Importantly, neither airports nor aircraft are specifically included among the source types regulated pursuant to Section 112 of the CAA (42 U.S.C § 7412) nor do they meet the definitions of the source types (i.e., "major stationary," "area," or "mobile sources") that are specifically covered under this section. Rather, all emissions from aircraft engines are currently regulated under Part B (*Aircraft Emission Standards*)[106] of the CAA. Therefore, although aircraft HAPs are not directly regulated under the CAA, they are indirectly controlled as elements of total unburned hydrocarbons (HC) and PM pursuant to Part B.

6.2.2. FAA Guidance

In 2003, the FAA undertook a review of publicly available information pertaining to the relationship(s) between aircraft and airport-related activities and the emissions of HAPs. This initial body of work focused on those emissions specifically identified by the EPA as HAPs and was prepared in response to the rising interest by various federal, state, local, and tribal governmental agencies and the general public in connection with these pollutants. Referred to as the *FAA Resource Document for HAPs*, this initial report was entitled and is described as follows:

- *Select Resource Materials and Annotated Bibliography on the Topic of Hazardous Air Pollutants (HAPs) Associated with Aircraft, Airports and Aviation.*[107]

  Among the key findings from this initial publication was the need for a more unified approach and technical guidelines for evaluating HAPs emissions for aviation-related

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104 EPA, *Section 112(k) - Urban Air Toxics Program Development of Air Emissions Inventory*, https://www.epa.gov/urban-air-toxics/urban-air-toxic-pollutants

105 *Control of Emission of Hazardous Air Pollutants From Mobile Sources,* 66 FR 17229 (March 29, 2001).

106 42 U.S.C. §§ 7571-7574.

107 FAA, *Select Resource Materials and Annotated Bibliography on the Topic of Hazardous Air Pollutants (HAPs) Associated With Aircraft, Airports and Aviation,* Technical Directive Memorandum D01-010, July 1, 2003, (document no longer available).

sources. Other topics include HAP types and sources, agency regulations, and air monitoring data associated with airports and aviation.

In response to this need for more information, in 2009, the EPA and the FAA developed organic gas (OG) speciation profiles and best practices for use in HAPs emission inventories of aircraft equipped with turbofan, turbojet, and turboprop engines fueled with kerosene-based jet-A fuel. The development of these profiles and guidance was the combined work of both agencies, taking into account the most recent data and information available. Referred to as the *Speciated Organic Gas Emissions from Aircraft Guidance*, this document is entitled and described as follows:

- *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines.*[108]

  The aircraft-related speciation profile developed from this initiative was used to update the OG profile for aircraft in the EPA SPECIATE database – the agency's multi-sector repository for such data. In this application, a *speciation profile* is the amount of OGs emitted based on the amount of VOCs emitted by an emission source.

Again in 2009, the FAA published a document providing an approach to, and technical guidance for, preparing speciated OG emission inventories for airport sources including aircraft, APUs, GSE, motor vehicles, and stationary sources. Referred to as the *Speciated Organic Gas Emissions from Airports Guidance*, this document is entitled and described as follows:

- *Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources.*[109]

  This guidance is intended to help ensure that OG/HAPs emission inventories prepared in support of environmental documents prepared by, or on behalf of, the FAA under NEPA are done so consistently. Importantly, it points out that emission inventories of aviation-related OGs, which include the OGs identified by the EPA to be HAPs and the OGs listed in the EPA's Integrated Risk Information System (IRIS),[110] are not required by current EPA regulations.[111] However, in those cases where it is desirable to prepare such an aviation-related HAP inventory, the inventory should be prepared following this guidance and using AEDT.

The FAA also recognized that the need to prepare an emissions inventory of OGs/HAPS is not widely instituted nor uniformly applied in connection with FAA Federal Actions. To address this discrepancy, FAA has provided a flow chart in the *Guidance for Quantifying Speciated Organic*

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[108] FAA and EPA, *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines (Version 1.0)*, May 2009 [EPA-420-R-09-901], https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1003YX3.TXT.

[109] FAA, *Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources,* Version 1, September 2, 2009, https://cupdf.com/document/guidance-for-quantifying-speciated-organic-gas-emissions-guidance-for-quantifying.html?page=1.

[110] Integrated Risk Information System (IRIS), http://www.epa.gov/iris/.

[111] For a detailed discussion of the relationship of HAPs and OG, along with other "groups" of OG, refer to Section 1.5.1 of FAA's *Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources*, Version 1, September 2, 2009, https://cupdf.com/document/guidance-for-quantifying-speciated-organic-gas-emissions-guidance-for-quantifying.html?page=1.

Gas Emissions from Airport Sources document that can be used to determine when an emissions inventory of OGs/HAPs should be prepared.

For FAA NEPA reviews, if a CATEX is applicable to the Federal Action and no extraordinary circumstance exists, then preparation of a HAPs emissions inventory is not warranted. As described in Section 4.5.1 on pollutant quantification, there are a limited number of instances when the proposed Federal Action requiring an EA or EIS should consider including a HAP emissions inventory. Furthermore, considerations should be given as to (i) whether the Federal Action normally requires an EIS (e.g., new airport, new runway, major runway extension, etc.); (ii) whether or not it is located in a nonattainment/maintenance area; and/or (iii) whether a criteria air pollutant emissions inventory is also prepared. In those cases where the magnitude of the project is uncertain, a HAP emissions inventory may also be prepared when called for during agency scoping or based on consultation with the appropriate FAA regional office.

6.2.3. HAPs Emissions Inventory Methods

Again, it is important to acknowledge that there are currently no federal regulatory guidelines specific to HAPs emissions from aircraft engines, specifically, and airports, in general. While the methodology discussed in this *Handbook* is useful for disclosure, reporting, and comparative purposes, it does not provide results that are directly comparable to any regulatory threshold or air quality standards.

It is also important to note that other than an emissions inventory, a HAPs assessment prepared for the FAA would not include any other type of analysis including, but not limited to, atmospheric dispersion modeling, toxicity weighting, or human health risk analyses. These types of assessments require a more complete understanding of the reactions of HAPs in the atmosphere and downstream plume evolution as well as human exposure patterns. Because the science of these relationships with respect to aviation-related HAPs is still evolving, the corresponding level of understanding is also currently limited. Prior to including any such assessment in a project scope, FAA field staff should coordinate with AEE-300.

As stated previously, in cases where it is desirable to prepare such an aviation-related HAP inventory, the inventory must be prepared following the *Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources* and using AEDT. In this application, AEDT applies speciation factors to quantify individual HAP compounds. These factors estimate the quantities of individual HAPs based on the total emissions of VOCs. Notably, the EPA MOVES emission factor model should be used to develop individual HAP speciation data for motor vehicles.

Presently, AEDT calculates emissions for a large array of different OGs. Of these, several dozen are classified as HAPs by the EPA while the remainder are considered to be non-toxic compounds. The HAPs are listed in **Table 6-4** (*Potential HAPs to be Included in an Airport Emissions Inventory*).

Table 6-4. Potential HAPs to be Included in an Airport Emissions Inventory

Hazardous Air Pollutants			
1,1,1-Trichloroethane	Cyclohexane	Methyl alcohol	Phenol (carbolic acid)

Hazardous Air Pollutants			
1,3-Butadiene	Dichloromethane	Methyl chloride	Phthalic anhydride
2,2,4 Trimethylpentane	Ethyl acetate	Methyl ethyl ketone	Propionaldehyde
2-Methylnaphthalene	Ethyl ether	Methyl tert butyl ether	Styrene
Acetaldehyde	Ethylbenzene	m-xylene	Toluene
Acetone	Ethylene bromide	Naphthalene	Trichloroethylene
Acrolein (2-propenal)	Ethylene glycol	n-Butyl alcohol	Trichlorotrifluoroethane
Benzaldehyde	Formaldehyde	n-Heptane	Vinyl acetate
Benzene	Isomers of xylene	n-Hexane	
Butyl cellosolve	Isopropylbenzene	o-Xylene	
Chlorobenzene	m & p-Xylene	Perchloroethylene	
Source: FAA, Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources, September 2, 2009, https://cupdf.com/document/guidance-for-quantifying-speciated-organic-gas-emissions-guidance-for-quantifying.html?page=1			

Importantly, the type(s) and number of HAPs reported in an aviation-related emissions inventory will depend on the type of airport sources that are evaluated and, in some cases, the type of fuel and other emission characteristics of the individual source(s) involved.

For most airport emission inventories, formaldehyde occurs in the greatest amounts followed by acetaldehyde, acrolein, and 1,3-butadiene. These compounds are emitted in the exhaust of aircraft, APUs, GSE, and motor vehicle engines and, to a lesser extent, from boilers, fuel facilities, and other stationary sources at an airport. Compounds such as benzene, ethylbenzene, naphthalene, toluene, hexane, styrene, and xylene also occur, but in far lesser amounts.

6.2.4. HAPs Emissions Inventory Results

As discussed previously, for HAPs emission inventories prepared as part of a NEPA analysis, the emphasis is on disclosing the incremental change in HAPs emissions between the proposed action (and alternatives) when compared to the no-action alternative. For consistency, HAPs emission inventories should also be reported in tons per year. **Table 6-5** (*HAPs Emissions Inventory Results*) provides a sample format for reporting HAP emissions. For simplification, total values are shown for each species of HAPs evaluated and comprise combined emissions from aircraft, APUs, GSE, motor vehicles, stationary sources, and fuel storage facilities.

Table 6-5. HAPs Emissions Inventory Results

Pollutant	HAPs Emissions Inventory (tons per year)					
	No Action		Alternative A		Alternative B	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
1,3-butadiene	3.92	4.58	3.93	4.45	3.80	4.58
2,2,4-trimethylpentane	0.28	0.23	0.28	0.23	0.28	0.23
2-methylnaphthalene	0.43	0.51	0.44	0.50	0.42	0.51
Acetaldehyde	9.92	11.6	9.95	11.3	9.61	11.6
Acetone	0.88	1.02	0.88	0.99	0.85	1.02
Acrolein	5.27	6.18	5.29	6.01	5.08	6.18
Benzaldehyde	1.03	1.20	1.03	1.17	0.99	1.20
Benzene	7.23	8.14	7.24	8.00	7.21	8.22
Chlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cyclohexane	0.02	0.02	0.03	0.03	0.03	0.03
Ethylbenzene	0.85	0.94	0.85	0.92	0.83	0.93
Formaldehyde	27.7	32.4	27.8	31.5	26.8	32.4
Isopropylbenzene (cumene)	0.03	0.04	0.03	0.04	0.03	0.04
M & P-xylene	1.92	2.19	1.92	2.17	1.90	2.19
Methyl alcohol	3.80	4.47	3.81	4.34	3.66	4.47
M-xylene	0.34	0.29	0.34	0.29	0.34	0.3
Naphthalene	1.23	1.44	1.23	1.40	1.18	1.44
N-heptane	0.49	0.52	0.50	0.52	0.49	0.52
N-hexane	0.77	0.78	0.77	0.78	0.77	0.78
O-xylene	1.08	1.18	1.08	1.17	1.06	1.18
Phenol (carbolic acid)	1.54	1.81	1.54	1.75	1.48	1.80
Propionaldehyde	1.62	1.90	1.63	1.84	1.57	1.89
Styrene	0.68	0.79	0.68	0.77	0.65	0.79
Toluene	3.32	3.64	3.33	3.60	3.28	3.64

It is again noteworthy that the HAPs emissions inventory results are not compared to the NAAQS or any other significance criteria. Rather, the information is provided for informational purposes as a means of disclosing the Federal Action's potential effects on HAPs.

6.3. Greenhouse Gases

Greenhouse gases (GHGs) are another category of pollutants for which there are no NAAQS but are of concern because of their climate-changing potential. **Section 3** (*Sources and Types of Air Emissions*) identifies and generally describes these emissions as they pertain to aviation. These include gases such as CO_2, CH_4, and N_2O as by-products of fuel combustion in aircraft, APU, GSE, and motor vehicle engines as well as emissions of HFCs, PFCs, and SF_6 linked with refrigeration and air conditioning.

This section addresses the available guidance and approaches for assessing these emissions in connection with FAA Federal Actions.

6.3.1. Introduction & Background

There is a broad scientific consensus that human activities, primarily in the form of GHGs, are contributing to changes in the earth's atmosphere, resulting in impacts such as rising oceanic temperatures, rising sea levels, and increased incidences of severe weather events, among others.[112] These GHGs, brought about principally by the combustion and release of fossil fuels, decomposition of waste materials, and deforestation, cause the "greenhouse effect" that leads to "global climate change" that has been observed worldwide.

As a result, the scientific community is continuing its efforts to better understand the impact of aviation emissions on the global atmosphere. In particular, the FAA is leading and participating in a number of initiatives intended to clarify the role that aviation plays in GHG emissions and climate. For example, the FAA, with support from the U.S. Global Change Research Program (GCRP)[113] and its participating federal agencies (i.e., NASA, NOAA, EPA, DOT, and DOE),[114] has developed the Aviation Climate Change Research Initiative (ACCRI)[115] in an effort to advance scientific understanding of the regional and global climate impacts of aircraft emissions. This effort also seeks to quantify uncertainties for current and projected aviation scenarios under changing atmospheric conditions.[116] The FAA also funded the Partnership for Air Transportation Noise & Emissions Reduction (PARTNER) and subsequently the Center of Excellence for alternative jet fuels and environment (ASCENT) research initiatives to quantify the effects of

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[112] USGCRP, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I, U.S. Global Change Research Program Climate Science Special Report https://science2017.globalchange.gov/chapter/executive-summary/.

[113] U.S. Global Change Research Program, http://www.globalchange.gov/about.

[114] National Aeronautics and Space Administration (NASA) at http://www.nasa.gov/, National Oceanic and Atmospheric Administration (NOAA) at http://www.noaa.gov/, and Department of Energy (DOE) at http://energy.gov/.

[115] FAA, *Aviation Climate Change Research Initiative*, https://www.faa.gov/sites/faa.gov/files/about/office_org/headquarters_offices/apl/ACCRI_Report_final.pdf.

[116] Nathan Brown, et. al. *The U.S. Strategy for Tackling Aviation Climate Impacts*, 2010, 27th International Congress of the Aeronautical Sciences.

aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. Similar research topics are being examined at the international level by the ICAO.[117]

In terms of U.S. contributions, the U.S. 2021 Aviation Climate Action Plan establishes a goal of "*Net-Zero GHG Emissions from the U.S. Aviation Sector by 2050.*"[118] Importantly, actions are underway within the U.S. and by other nations to reduce aviation's contribution of GHGs. Such actions, which are in varying degrees of development, include new aircraft technologies to reduce emissions and improve fuel efficiency, renewable alternative fuels with lower carbon footprints, more efficient air traffic management, FAA airport-reduction programs, market-based measures, and environmental regulations, including an aircraft CO_2 standard.

6.3.2. FAA NEPA Guidance

FAA's guidance for assessing and reporting upon climate change and GHGs in NEPA documents is included in the **Appendix to this Handbook**. It is important to note that while criteria pollutants only need to be considered below the mixing height, GHGs need to be considered for the full range of impacts being examined in a Federal Action and that may require analyzing emissions above the mixing height. The Appendix to this Handbook is subject to change, so please reference the Appendix regularly to ensure use of the most current guidance.

On January 9, 2023, the Council on Environmental Quality (CEQ) issued interim guidance for public comment, entitled *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change* (2023 Interim Guidance) establishing uniform practices for assessing the effects of GHG and climate change effects of proposed federal projects pursuant to NEPA. The 2023 Interim Guidance provided guidance to practitioners on multiple aspects of GHG analyses, including when and how GHGs should be quantified, the contextualization of GHGs, analysis of reasonable alternatives, mitigation of GHG emissions, and engagement with environmental justice communities. The guidance in the Appendix currently is focused on only two elements of the 2023 Interim Guidance: 1) quantification of GHG emissions; and 2) contextualization of GHG emissions. On May 1, 2024, CEQ issued its final rule (Phase 2 Rule) updating its NEPA implementing regulations. The Phase 2 Rule re-affirms that environmental documents should include analysis of "Where applicable, climate change-related effects, including, where feasible, quantification of greenhouse gas emissions, from the proposed action and alternatives and the effects of climate change on the proposed action and alternatives" (see 40 CFR § 1502.16(a)(6)).[119]

For questions on how to conduct the GHG assessment and discuss the results, please contact AEE. Please note that additional documentation, beyond that recommended in the Appendix, may be needed to comply with state, local, or tribal requirements.

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[117] Lourdes Q. Maurice and David S. Lee. Chapter 5: *Aviation Impacts on Climate. Final Report of the International Civil Aviation Organization (ICAO) Committee on Aviation and Environmental Protection (CAEP) Workshop*, October 29th - November 2nd 2007, Montreal.

[118] United States, *2021 Aviation Climate Action Plan*, December 2021; https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf.

[119] 89 Fed. Reg. 35494 (May 1, 2024).

6.3.3. Methodology

In general, FAA's GHG emissions inventory procedures are intended to accomplish the following:

- Identify and characterize the types and sources of GHGs to include in an emissions inventory.
- Apply appropriate and consistent methods for calculating GHG emission inventories.
- Aid in the integration of GHG inventories into larger regional, national, and global inventories.
- Clarify the specific makeup and percent contribution of applicant-generated GHGs, by source and emission type.
- Provide necessary inputs for contextualizing GHG emissions and climate effects using the social costs of greenhouse gas emissions (SC-GHG) methodology as described in the Appendix to this Handbook. This contextualization method translates the metric tones of emissions for a project into a monetary value that describes the net social costs of increasing GHG emissions as well as the net social benefits of reducing such emissions.

6.3.4. GHG Emissions Inventory Methods

As discussed in **Section 3** (*Sources and Types of Air Emissions*), the primary sources of GHG emissions that are typical of most FAA Federal Actions include aircraft, APUs, GSE, an assortment of stationary sources, and motor vehicles (operating on the airport's internal roadways, parking facilities and terminal curbsides, and off-airport roadways). For the most part, emissions from these sources arise from the combustion of fossil fuels (e.g., jet fuel, avgas, diesel, gasoline, CNG, etc.) and are emitted as by-products contained in the engine exhaust.

Because GHG emissions are primarily a function of fossil fuel use, most of the emission calculations for each source are based on estimating or obtaining fuel use (or activity) data and then applying the appropriate GHG emission factor (i.e., pounds per gallon or grams per mile traveled), as follows:

GHG emissions = (Fuel Use or Activity Level) x (Emission Factor)

For example, when calculating aircraft-related GHG emissions, fuel use can be obtained from airport fuel throughput data for jet fuel and avgas or computed from AEDT. Importantly, GHG emissions beyond the mixing height of the study area (i.e., cruise mode) may need to be calculated if these are relevant potential impacts from the Federal Action being considered in the NEPA analysis. For APU GHG emissions, fuel use can be obtained from manufacturer fuel flow rates. These data can then be converted to GHG emissions using appropriate emission factors for each fuel type (e.g., jet fuel, avgas, etc.). There is an array of tools[120] that can be used, some of the more common approaches include:

GHGs from GSE can be computed from fuel use and/or operational time from the EPA MOVES model (or airport records) and then combined with fuel-specific emission factors (e.g., gasoline, diesel, CNG, etc.).

[120] https://ceq.doe.gov/guidance/ghg-tools-and-resources.html

Similarly, the EPA MOVES model provides GHG emission factors for a variety of motor vehicle types and operating speeds. These emission factors are typically reported in grams per mile traveled and can be combined with aviation-related motor vehicle traffic volumes to determine GHG emissions.

GHG emissions from stationary sources are also largely based on fuel throughput data combined with emission factors for each fuel type (e.g., diesel, natural gas, etc.).

GHG emissions associated with the onsite generation of electricity using coal, oil, natural gas, etc. may be included in an aviation-related GHG emissions inventory. Typically, these values are based on aviation-related electrical usage and emission factors from local utilities or from the EPA eGRID[121] system.

The GHG emissions associated with refrigeration and heating and air-conditioning systems as well as the GHG emissions from recycling of solid waste associated with an airport are likewise occasionally included. These values are based mostly on product-specific material-balancing methods and emission factors which take into account the use and disposal of these materials.

Moreover, the storage of fuel (e.g., jet fuel, avgas, gasoline, and diesel) is a potential source of evaporative hydrocarbon emissions, but does not produce the type of HCs that contribute directly to global climate change.

Due to the fact that CO_2, CH_4, and NO_2 are by-products of fuel combustion, they are also the predominant GHGs associated with most Federal Actions. Emissions of HFCs, PFCs, and SF_6 linked with refrigeration, air conditioning, and other coolants also occur, but at far lesser amounts.

Table 6-6 provides a summary of the emissions inventory methods.

Table 6-6. GHG Emissions Inventory Methods

Source	Method
Aircraft Engines	Fuel use rates within the study area based on AEDT combined with fuel-specific emission factors.
APUs	Fuel use rates from AEDT combined with fuel-specific emission factors.
GSE	Fuel use or fuel use rates from MOVES combined with fuel-specific model emission factors.
Ground Access Vehicles	Fuel use or VMT combined with emission factors from MOVES model.
Stationary Sources	Fuel use combined with fuel-specific emission factors.
Electric Usage	Kilowatt hours combined with emission factors from local utility and/or eGRID system.
Refrigeration, Heating, Air Conditioning	Material balancing accounting for charging, use and disposal combined with appropriate emission factors.

[121] EPA, *Emissions & Generation Resource Integrated Database (eGRID)*, https://www.epa.gov/egrid.

Source	Method
Solid Waste Recycling	Material amounts combined with WARM model emission factors.

6.3.5. GHG Emissions Inventory Results

As discussed above, the Appendix to this Handbook provides guidance on the quantification of aviation-related GHG emissions inventories and contextualizing the emissions by preparing the social cost of greenhouse gasses. It is recommended that GHG emission inventories should be reported both for individual GHGs and in MT CO_{2e}.

For the quantification of GHG emission prepared as part of a NEPA analysis, the emphasis is on disclosing the incremental change in GHG emissions between the proposed action (and alternatives) when compared to the no-action alternative and providing context for those emissions in terms of the social cost of greenhouse gasses (a monetary estimate of costs for their emission). **Table 6-7** provides a sample format for reporting GHG emissions and the Appendix to this Handbook provides examples of contextualizing the social cost of carbon computation methodology and reporting instructions

Table 6-7. Quantification of GHG Emissions for NEPA Documents

Alternative	GHG Emissions (MT CO_{2e})	Difference from No Action (MT CO_{2e})	% Difference from No Action
No Action	3,910,933	--	--
Alternative A	3,928,321	17,388	0.44
Alternative B	3,929,648	18,715	0.48

Table 6-8. Airport GHG Emissions Summary by Source, and Scope

Source/Category	Scope	GHG Emissions (MT CO_{2e})	
		2020	2025
Airport Owned/Controlled			
Stationary Sources – Combustion	1	3,435	3,435
Stationary Sources – Refrigerants	1	675	675
Fleet Vehicles	1	3,572	4,191
Electrical Consumption	2	7,281	7,281
On-airport Roadways	3	27,385	32,134
Parking Ramps/Lots	3	3,708	4,184
Total - Airport Owned/Controlled		**46,054**	**51,899**
Tenant Owned/Controlled			
Aircraft (Ground-based)	3	204,053	243,432
Aircraft (Ground to 3,000 feet)	3	252,473	276,820
Aircraft - Engine Startup	3	3,187	3,461
APUs	3	22,417	25,180
Subtotal – Aircraft		*482,130*	*548,893*
GSE	3	33,482	37,912
Stationary Sources – Combustion	3	22,037	22,037
Electrical Consumption	3	91,446	91,446
Total - Tenant Owned/Controlled		**629,095**	**700,288**
Passenger Owned/Controlled			
Off-Airport Roadways (Aviation-related only)	3	57,769	68,497
Total - Passenger Owned/Controlled		**57,769**	**68,497**
Grand Total		686,910	820,684
Note: Totals may differ from sum due to rounding.			

Note that the GHG emissions inventory results are not compared to the NAAQS nor any other significance criteria. As previously mentioned, while criteria pollutants only need to be considered below the mixing height, GHGs need to be considered above that level.

7. Conducting Dispersion Modeling for Criteria Air Pollutants

This section addresses two types of atmospheric dispersion modeling conducted in support of FAA Federal Actions: (i) multi-source dispersion modeling for operational and construction activities and (ii) hot-spot roadway dispersion modeling. It is noted that dispersion modeling generally is only appropriate when required by General Conformity or Transportation Conformity requirements and thus it is important to carefully evaluate if and when it is appropriate.

7.1. Atmospheric Dispersion Modeling for Airports

This section discusses the recommended approaches for conducting and reporting atmospheric dispersion modeling of aviation-related emissions in connection with FAA Federal Actions. EPA's **Appendix W to 40 CFR Part 51** provides additional information on dispersion modeling methods, data requirements, and other supporting materials.

7.1.1. Introduction & Background

In general terms, dispersion modeling is the process by which the dispersal of atmospheric pollutants are simulated and assessed under the effects of meteorological, terrain, and other influencing factors. Computer models such as the American Meteorological Society/EPA Regulatory Model (AERMOD) have been developed and are used for this purpose. The results of this modeling allow for the prediction of pollutant concentrations at or near an emission source(s) and enable the comparison of these results to the NAAQS. It is important to understand that dispersion modeling is normally conducted as one approach to demonstrating General Conformity for certain localized criteria air pollutants.[122] The other requirement to perform dispersion modeling would be for a project level conformity hot spot analysis required by the Transportation Conformity requirements.[123] If neither of these two regulatory requirements apply to a project, it is recommended that FAA's Office of Emissions (AEE-300) be consulted prior to including dispersion modeling in an environmental analysis. It is noted that 40 CFR 93.158 does not include a dispersion modeling methodology for reactive pollutants (e.g. ozone) to demonstrate conformity.

7.1.2. EPA Guidance

EPA's principal guidance for conducting dispersion modeling and assessing air quality impacts on nearby receptors is *Appendix W to Part 51 - Guideline on Air Quality Models.*[124] This guidance contains recommendations and supporting information on the selection and applications of air quality models, determining background concentrations and the use of meteorological data. This guidance also specifies dispersion models required to be used for SIP revisions, general conformity, and for New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs.

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[122] 40 CFR 93.158(a)(3)(i)

[123] 40 CFR 93.116(a) and 93.123(b)

[124] Appendix W to Part 51 – https://www.epa.gov/scram/clean-air-act-permit-modeling-guidance.

Notably, dispersion modeling requirements and methodologies may vary by purpose and/or locale, thus state, regional, and/or tribal air quality regulatory agencies should be consulted on the methodology, assumptions, and data sources utilized.

However, as discussed previously in **Section 5** (*Air Quality Assessment Models*), the FAA's AEDT is the required model for performing air quality assessments of aviation-related sources in support of FAA projects/actions.[125] Coupled with AERMOD, AEDT computes spatially- and temporally-allocated emissions associated with airport activities and estimates the resulting pollutant concentrations.

In brief, AERMOD can simulate emission sources as point, area, volume, and line sources over simple, intermediate, and complex terrains. It also has the capability to predict both maximum short-term (i.e., 1 to 24 hours) and average long-term (i.e., quarterly or annual) concentrations. In order to support all criteria of **Appendix W to 40 CFR 51**, AERMOD contains preprocessors, including AERMET,[126] AERMAP,[127] and AERSURFACE[128] for the processing of meteorological and terrain data.

The EPA's principal guidance documents for using AERMOD are listed below and described as follows:

- *User's Guide for the AERMOD* – Addresses the regulatory application of AERMOD for assessing criteria pollutants under the CAA.[129]
- *AERMOD Implementation Guide* – Provides information on the recommended use of AERMOD and addresses specific topics such as meteorological data processing, terrain processing, urban environment applications, and source release characteristics. [130]
- *AERMOD: Description of Model Formulation* – Provides a comprehensive and detailed description of the technical formulation of AERMOD and its preprocessors.[131]

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125 FAA, *Noise, Fuel Burn, and Emissions Modeling Using the Aviation Environmental Design Tool Version 2b*, 27853 Federal Register/Vol. 80/May 29, 2015/Rule, https://www.federalregister.gov/documents/2015/05/15/2015-11803/noise-fuel-burn-and-emissions-modeling-using-the-aviation-environmental-design-tool-version-2b

126 EPA, Preferred/Recommended Models, *AERMET – Date 04/22/2021*, https://www.epa.gov/scram/meteorological-processors-and-accessory-programs#aermet.

127 EPA, Preferred/Recommended Models, *AERMAP – Version 18081*, https://www.epa.gov/scram/air-quality-dispersion-modeling-related-model-support-programs#aermap.

128 EPA, Preferred/Recommended Models, *AERSURFACE – Version 20060*, https://www.epa.gov/scram/air-quality-dispersion-modeling-related-model-support-programs#aersurface.

129 EPA, *User's Guide for the AMS/EPA Regulatory Model - AERMOD*, April 2021 [EPA-454-B-21-001], https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/aermod_userguide.pdf.

130 EPA, *AERMOD Implementation Guide*, Last Revised: July 01, 2021, https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/aermod_implementation_guide.pdf.

131 EPA, *AERMOD: Description of Model Formulation*, April 2021, [EPA-454-B-21-003], https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1009OXW.TXT.

- *AERSURFACE User's Guide* – Aids in the determination of land surface characteristics based on land use cover, soil moisture, and seasonal conditions for use in AERMET.[132]
- *User's Guide for the AERMOD Meteorological Preprocessor (AERMET)* – Provides a methodology to process and organize meteorological data into a format suitable for use by the AERMOD.[133]
- *User's Guide for the AERMOD Terrain Preprocessor (AERMAP)* – Provides a physical relationship between terrain features and the behavior of air pollution plumes. [134]

7.1.3. Dispersion Modeling Methods

Typically, the first step in dispersion modeling is to compile detailed information on the emission sources being modeled. This information includes the source emission rates (including temporal variations), release characteristics, location coordinates, and source layout. For an airport, these emission source data may take the form of an aircraft fleet mix, runway and taxiway locations, gate assignments, stack height, and airport operational profiles.

Second, representative meteorological information is required, typically obtainable from publicly-available databases; this data includes wind speed, wind direction, and atmospheric stability (i.e., surface roughness, albedo, and Bowen Ratio). For those locations with variable terrain, local topographic data may also be required. Similarly, locations of interest are identified, and pollutant concentrations are computed at those locations by defining those locations as "receptors" to the model.

Finally, appropriate background concentrations are added to the computed concentrations to represent the contributions from all other emission sources within the study area. In the event that conservatively assuming that all oxides of nitrogen are emitted as NO_2 is too cautious, the technical analysis should be enhanced to examine of NO_2 concentrations by considering the conversion of nitric oxide (NO) to NO_2.

For clarity, this multi-step process of setting up and running a dispersion model such as AERMOD for aviation-related sources is summarized as follows:

- *Select model options* – Model options include averaging periods, pollutant types, urban vs. rural setting, receptor layout, and data output format.
- *Select emission source characteristics* – Develop source release conditions for point, area, line, and volume sources including emission rate, stack height and diameter, exhaust temperature and exit velocity, source length and width, and volume height above ground level. Also, source locations are to be provided to create a spatial relationship between sources and receptors. These are generally calculated by the AEDT model for aircraft sources.

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132 EPA, *AERSURFACE User's Guide*, February 2020, [EPA-454-B-20-008], https://gaftp.epa.gov/Air/aqmg/SCRAM/models/related/aersurface/aersurface_ug_v20060.pdf.

133 EPA, *User's Guide for the AERMOD Meteorological Preprocessor (AERMET)*, April 2021, [EPA-454-B-21-004], https://gaftp.epa.gov/Air/aqmg/SCRAM/models/met/aermet/aermet_userguide.pdf.

134 EPA, *User's Guide for the AERMOD Terrain Preprocessor (AERMAP)*, April 2018 [EPA-454-B-18-004], https://gaftp.epa.gov/Air/aqmg/SCRAM/models/related/aermap/aermap_userguide_v18081.pdf.

- *Select meteorological data* – Develop meteorological data such as wind speed, wind direction, turbulence indices, temperature, and relative humidity using the AERMET processor and surface/upper air data from the nearest representative monitoring station.
- *Select terrain data* – Digital elevation data is used to determine elevations for sources and receptors using AERMAP and account for wind and plume behavior associated with terrain features (this feature is not available in AEDT, but can be used with AERMOD).
- *Select receptor site locations* – The locations at which concentrations are estimated are known as receptors. Generally, receptors are located where the general public is likely to have continuous access.
- *Determine background concentrations* – Background concentrations are typically obtained from a representative background monitoring site not affected by the modeled emission source(s).
- *Tabulate results* – Representative background concentrations should be added to the model predicted concentrations.

For airport applications, the typical AERMOD input requirements and their corresponding data parameters are listed in **Table 7-1** (*AERMOD Model Inputs and Data Requirements*).

Table 7-1. AERMOD Model Inputs and Data Requirements

Model Inputs	Data Parameters
Model Options	• Averaging time • Pollutants • Urban versus rural
Emission Source Release Parameters	• Location coordinates • Area dimensions • Roadway link length and width • Stack height • Stack diameter • Exit temperature • Exit velocity
Meteorological Data	• Surface/upper air conditions • Wind speed and direction • Ambient temperature • Mixing height • Surface roughness, albedo, Bowen ratio
Spatial Allocation	• Runway coordinates • Runway utilization • Taxiways and taxipaths • Gate assignments • Airport capacity and configuration
Temporal Profiles	• Quarter hour • Daily • Monthly
Topography Data	• Source and receptor elevations

Model Inputs	Data Parameters
Building Downwash	• Building height and dimensions • Stationary source locations
Receptor Locations	• Location coordinates • Flagpole height
NO to NO_2 Conversion	• In-stack emission ratio • Ozone concentrations • Initial ozone concentration
Background Concentrations	• Nearby ambient monitoring data
Source: EPA Preferred/Recommended Models, *AERMOD Modeling System*, https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod.	

When dispersion modeling is conducted at airports for the criteria pollutants, CO, NO_2, PM_{10}, and $PM_{2.5}$ are most commonly evaluated. Characteristically, CO levels are typically elevated in areas of high motor vehicle traffic such as the main terminal area access/egress roadways, curbsides, and parking facilities. By comparison, NO_2 concentrations are more likely to be highest near the runway ends where aircraft engine thrust settings are at their highest. PM_{10} and $PM_{2.5}$ levels are generally more ubiquitous across the airport but similarly elevated near areas of high activity levels and/or emission sources within close proximity to each other.

Dispersion modeling of SO_2 and Pb are much less frequently conducted due to their expected low ambient levels. Elevated Pb concentrations are not usually associated with commercial airports but may be found near airports with significant avgas usage. Ozone is a regional pollutant resulting from the combined effects of VOCs and NO_x in the presence of sunlight and thus not suitable for dispersion modeling.

7.1.4. Dispersion Modeling Results

Normally for airport applications, the output of the dispersion model is the maximum or average concentration(s) of a pollutant (or set of pollutants) at each receptor analyzed and over a specified time period (i.e., 1-, 3-, 8-, 24-hour to annual). These time periods typically correspond to the same pollutant-specific time periods stipulated as part of the NAAQS.

For FAA NEPA reviews, reporting the results of dispersion modeling is primarily intended to disclose the differences in pollutant concentrations between the proposed action (and alternatives) when compared to the no action alternative and to demonstrate that the action does not cause any violations of the NAAQS. For the purposes of General Conformity, the principal intent of dispersion modeling is to show that the Federal Action will not cause or contribute to a violation of any NAAQS nor delay the attainment of any NAAQS. **Table 7-2** provides a sample format for reporting dispersion modeling results in support of FAA Federal Actions for an array of pollutants that all are being evaluated pursuant to 40 CFR 93.158 (a)(3)(i). As previously described, General Conformity does not require dispersion modeling of attainment pollutants nor nonattainment pollutants not demonstrating conformity pursuant to this section. As shown, the results are

typically presented in µg/m^3, although they can also be reported as ppm.[135] In most cases, the concentrations are reported with the background values added for easy comparison to the NAAQS. In this example, the reported values represent the highest concentrations of all the receptors analyzed.

It is important to note that in some instances the background values may be near or exceed the NAAQS by themselves and the effects of the Federal Action's contribution is minimal by comparison. In these cases, it should be clearly documented in the results that the Federal Action was not the cause of the predicted violation(s).

Table 7-2. Dispersion Modeling Results

Pollutant	Averaging Period	NAAQS	Modeling Year (µg/m^3)			
			2015		2020	
			No Action	Proposed Action	No Action	Proposed Action
NO_2	1-hour	188	123	142	120	150
	Annual	100	78.5	78.8	77.3	80.8
CO	1-hour	40,000	19,800	19,900	20,800	20,000
	8-hour	10,000	8,000	8,400	7,200	8,200
SO_2	1-hour	196	51	48	50	47
PM_{10}	24-hour	150	54.6	54.5	55.2	54.1
$PM_{2.5}$	24-hour	35	29.5	29.7	29.8	29.3
	Annual	12	9.7	9.6	9.6	9.5
Note: Results include background concentrations. µg/m^3= micrograms per cubic meter.						

7.2. Roadway Dispersion Modeling

This section addresses the approaches for assessing emissions from roadway intersections in connection with the Transportation Conformity regulations. The EPA's *Project-Level Conformity and Hot-Spot Analyses*[136] provides additional information on dispersion modeling methods, data requirements, and other supporting materials.

[135] If results reported in micrograms per cubic meter (µg/m^3), temperature and pressure should be specified at 25 degrees C (°C) and 1 atmosphere since values change with temperature and pressure. In contrast, results in parts per million do not change with temperature and pressure.

[136] EPA, *Project-Level Conformity and Hot-Spot Analyses*, https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses

7.2.1. Introduction & Background

A roadway intersection analysis, also known as a "hot-spot" analysis[137] is typically performed pursuant for a project specific analysis under the requirements of Transportation Conformity. It is important to note that FHWA/FTA would most likely be responsible for the approval of the Transportation Conformity determination. Including this analysis in an FAA NEPA document would be appropriate for consideration of cumulative impacts. This hot-spot analysis would never be included in an FAA General Conformity evaluation since emissions covered by Transportation Conformity are explicitly excluded from consideration in General Conformity[138].

The main pollutants of concern in a hot-spot analysis are CO, PM_{10}, and $PM_{2.5}$. At aviation facilities, these emissions arise from motor vehicles (e.g., cars, trucks, vans, buses, etc.) traveling and idling along on- and off-airport roadways. For this analysis, the pollutant concentrations would be analyzed at each applicable intersection(s), combined with a background concentration, and then compared to the appropriate NAAQS.

7.2.2. Transportation Conformity Guidance

CAA conformity requirements under 42 U.S.C § 7506 ensure emissions from transportation projects conform to air quality plans within areas designated by the U.S. EPA as nonattainment or maintenance[139] with respect to the NAAQS. The specific procedures, referred to as the Transportation Conformity requirements (see **Section 8**, *Conformity),* apply to transportation programs, transportation plans, and FHWA/FTA projects.[140] The Transportation Conformity regulations for localized CO and PM hot-spot analyses are codified within 40 CFR Part 93, Subpart A.[141] It is important to note that only a small subset of FAA Federal Actions are subject to Transportation Conformity.

When conducting a hot-spot analysis for the purposes of complying with Transportation Conformity, the EPA-preferred/recommended dispersion and emission models[142] are the

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137 A hot-spot analysis is defined in 40 CFR 93.101 as "…*an estimation of likely future localized CO, PM10, and/or PM2.5 pollutant concentrations and a comparison of those concentrations to the NAAQS. Hot-spot analysis assesses impacts on a scale smaller than the entire nonattainment or maintenance area, including, for example, congested roadway intersections and highways or transit terminals, and uses an air quality dispersion model to determine the effects of emissions on air quality to the NAAQS.*"

138 40 CFR 93.153(a) and 93.153(b).

139 The attainment designations mean that criteria pollutant levels have historically met the NAAQS. The maintenance and nonattainment designation signifies that violations of the NAAQS have occurred in the past .

140 40 CFR 93.102(a). Note that 40 CFR 93.121 applies to certain projects that are not FHWA/FTA projects if they are regionally significant under 40 CFR 93.101.

141 Title 40 CFR Part 93, Subpart A - *Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 U.S.C. or the Federal Transit Laws,* https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93/subpart-A.

142 Appendix W to Part 51 – *Guideline on Air Quality Models*, https://www.ecfr.gov/current/title-40/part-51/appendix-Appendix%20W%20to%20Part%2051 describes EPA's recommended models. Also see EPA's Technology Transfer Network Support Center for Regulatory Atmospheric Modeling at https://www.epa.gov/scram/, EPA's *MOVES (Motor Vehicle Emission Simulator)* at https://www.epa.gov/moves/, and the *EMFAC model issued by the California Air Resources Board* at https://arb.ca.gov/emfac/.

CAL3QHC/CAL3QHCR and AERMOD, and MOVES/EMFAC (see **Section 5**, *Air Quality Assessment Models*), respectively.

CO Project-level Analyses

NEPA air quality analyses have typically focused on CO as the primary indicator of vehicular air quality impacts. A CO project-level hot-spot analysis is performed to ensure that new or worsened violations of the NAAQS will not occur as a result of a Federal Action. Presently, EPA in coordination with FHWA and FTA, has provided the following guidance documents for conducting CO hot-spot analyses for project-level air quality requirements under Transportation Conformity:

- *Guideline for Modeling Carbon Monoxide from Roadway Intersections*[143]

  This guidance provides the methodology for estimating the air quality impacts associated with vehicular traffic at intersection(s) to determine if such impacts may exceed the NAAQS for CO.

- *Using MOVES in Project-Level Carbon Monoxide Analyses*[144]

  This guidance supersedes the emission factor sections from the 1992 CO Guidelines to reflect the use of the MOVES emissions model for project-level CO analyses. In particular, this guidance describes how to use the MOVES emissions model to estimate CO emissions from transportation projects, including roadway intersections, highways, transit projects, parking lots, and intermodal terminals. This guidance can be applied when using MOVES to complete any project-level quantitative CO analysis, including hot-spot analyses for transportation conformity determinations, modeling project-level emissions for SIP development, and completing analyses pursuant to NEPA.

PM Project-level Analyses

PM (i.e., PM_{10} and $PM_{2.5}$) hot-spot analyses are required for projects of local air quality concern, which include certain highway and transit projects that involve significant levels of diesel vehicle traffic and any other project identified in the PM SIP as a localized air quality concern. Presently, the principal guidance document for assessing PM hot-spot analysis issued by EPA (in coordination with DOT) is the following:

- *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*[145]

  This guidance describes how to complete quantitative hot-spot analyses for certain highway and transit projects in PM_{10} and $PM_{2.5}$ nonattainment and maintenance areas. In addition, this guidance describes transportation conformity requirements for hot-spot

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143 EPA, *Guideline for Modeling Carbon Monoxide from Roadway Intersections*, https://www.epa.gov/sites/default/files/2020-10/documents/coguide.pdf.

144 EPA, *Using MOVES in Project-Level Carbon Monoxide Analyses,* December 2010 [EPA-420-B-10-041], https://nepis.epa.gov/Exe/ZyPDF.cgi/P1009HZG.PDF?Dockey=P1009HZG.PDF.

145 EPA, *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Non-attainment and Maintenance Areas,* October 2021 [EPA-420-B-21-037], https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013C6A.pdf.

analyses, and provides technical guidance on estimating project emissions with EPA's MOVES model, California's EMFAC model, and other methods.

8. Conformity Under the Clean Air Act

The Clean Air Act (CAA) section 176(c)[146] conformity requirement integrates air quality planning on the state level with project planning on a federal level. This serves to protect the integrity of states' plans for improving air quality when federal agencies propose their actions within areas of states' jurisdiction and authority (*i.e.,* nonattainment and maintenance areas). Under the *Clean Air Act Amendments of 1990*, the EPA enhanced the CAA conformity requirement to put increased emphasis on reconciling emissions from a federal action[147] with a state's applicable implementation plan (SIP) for pollution prevention and control.[148] This way, consideration of emissions' controls occurs before a federal action is implemented rather than considering control measures afterward.

When a federal agency proposes an action that would cause emissions to occur within a nonattainment or maintenance area, a state must have assurance from the agency that the state's SIP growth projections will not be exceeded, its emissions reduction progress targets will not be delayed, and the emissions caused by the action will not interfere with the state's ability to attain and maintain the National Ambient Air Quality Standards (NAAQS).[149,150] To that end, under the CAA conformity requirement—

> *No department, agency or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to an implementation plan after it has been approved or promulgated under 42 U.S.C. § 7410. No metropolitan planning organization designated under 23 U.S.C. § 134 shall give its approval to any project, program, or plan which does not conform to an implementation plan approved or promulgated under 42 U.S.C. § 7410.The assurance of conformity to such an implementation plan shall be an affirmative responsibility of the head of such department, agency, or instrumentality.*

42 U.S.C. §7506. In addition, the CAA conformity requirement contributes to the protection of human health and welfare, and the environment, by ensuring federal agencies[151] engage state air quality planners and the public before taking an action that could impede the progress of improving air quality within a state. Conformity to the SIP means—[152]

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146 42 U.S.C. § 7506. *Limitations on certain Federal assistance*.

147 Conformity for FAA actions falls mostly within the definition of a *major federal action* under 40 CFR 1508.18 (q)(3)(ii) and (iv), referring to Airport Layout Plans (ALPs) or Airport Improvement Plan (AIPs), which include approval of specific projects, such as construction or management activities located in a defined geographic area.

148 42 U.S.C. § 7401(a)(3). *Congressional findings and declaration of purpose.*

149 42 U.S.C. § 7506; 40 CFR Part 50. *See also* section 2.2.1. *National Ambient Air Quality Standards*, in this document.

150 58 Fed. Reg. 63214, 63215. Nov. 30, 1993. Section II. *Background*.

151 For purposes of this *Handbook*, "federal agency" refers to any department, agency, or instrumentality of the Federal Government (*see* 42 U.S.C. § 7506(c)(1)).

152 42 U.S.C. § 7506(c)(1)A), (B).

(A) conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards; and

(B) that such activities will not—

(i) cause or contribute to any new violation of any standard in any area;

(ii) increase the frequency or severity of any existing violation of any standard in any area; or

(iii) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area."

This chapter focuses on the preparation of a General Conformity evaluation. FAA is providing this explanatory guidance to assist stakeholders in the planning, organization and finalization of consistent conformity evaluations that will meet the legal requirements for all FAA Federal Actions. The foundation information and procedural steps described in this chapter are designed to help identify Federal Actions that are subject to the conformity requirement, gauge the likelihood that an action will require a conformity determination, and learn how to navigate through the reporting and public participation requirements. The procedures are supplemented by helpful flowcharts that allow a "quick look" at what to do, how to do it, and when to do it. The conformity evaluation is organized, for the purpose of this *Handbook*, into four parts—

Part I—Actions Subject to General Conformity (**Section 8.3**);

Part II—Applicability Analysis (**Section 8.4**);

Part III—Demonstration, Draft Determination, Reporting and Public Participation (**Section 8.5**); and

Part IV—Final Determination, Reporting and Response to Comments. (**Section 8.6**).

Introductory **Sections 8.1** and **8.2** provide basic information on the regulatory structure of conformity, NEPA and how they work together, and explain how, when combined with state and local air quality planning, they provide the framework that allows states to attain and maintain the NAAQS.

8.1. Conformity Regulations and Enforcement

Conformity applies to two distinct types of federal actions—transportation related actions and non-transportation related actions. For both types of federal actions, the CAA conformity requirement directed the EPA to promulgate and periodically update the criteria and procedures for demonstrating and determining how emissions caused by federal actions will conform to a SIP.[153] Accordingly, the EPA implemented the CAA conformity requirement for transportation-related actions under 40 CFR part 93 subpart A (the Transportation Conformity regulations), and all remaining "general" federal actions are applicable under 40 CFR part 93 subpart B (the General Conformity regulations).

[153] 42 U.S.C. § 7506(c)(4)(A), (B).

The primary differences between the Transportation and General Conformity regulations are the type of emission sources the control and when a conformity determination is triggered.

8.1.1. Transportation Conformity Regulations

The Transportation Conformity program[154] was established in 1993[155] and EPA subsequently published several amendments. The Transportation Conformity regulations apply to transportation improvement programs, transportation projects and transportation plans[156] as defined in 40 CFR 93.101. The transportation conformity rules also apply to projects that meet the definition of a regionally significant project[157] implemented by an entity receiving funding from the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA).[158] However, where only transportation conformity applies, emissions from construction of transportation facilities are not considered.

These regulations establish criteria and procedures for determining whether transportation programs, projects and plans require a conformity determination, which is triggered by exceeding the screening thresholds established within the SIP for the Motor Vehicle Emissions Budget (MVEB),[159],[160] above which a determination is required.

The evaluation of Transportation Conformity is the responsibility of the U.S. Department of Transportation and the local MPO that develops the regional transportation plan. The EPA Office of Transportation and Air Quality (OTAQ) is responsible for management of the Transportation Conformity program.

8.1.2. General Conformity Regulations

The General Conformity regulations[161] were also published in 1993[162] and existed without revisions for many years. The EPA finalized a major revision to the regulations in 2010,[163] and revised it again in 2016to add precursors for the secondary formation of $PM_{2.5}$ emissions and to establish *de minimis* threshold rates for the pollutant and its precursors. [164] The major

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[154] 40 CFR part 93, subpart A.

[155] Criteria and Procedures for Determining Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Funded or Approved Under Title 23 U.S.C. or the Federal Tranit Act, 58 FR 62188 (November 24, 1993).

[156] 40 CFR 93.102(a)(1).

[157] 40 CFR 93.101.

[158] 40 CFR 93.102(a)(2).

[159] See 40 CFR 93.101 for the definition of Motor Vehicle Emissions Budget.

[160] 40 CFR 93.104(e)

[161] 40 CFR part 93 subpart B.

[162] Determining Conformity of General Federal Actions to State or Federal Implementation Plans, 58 FR 63214 (November 30, 1993).

[163] Revisions to the General Conformity Regulations, 75 FR 17254 (April 5, 2010).

[164] Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements; Final Rule, 81 FR 58010 (August 24, 2016).

changes in the 2010 revisions of the rule included the elimination of the requirement for a regional significance analysis, the requirement for states to develop and adopt their own general conformity regulations and the new program to develop Early Emissions Reduction Credits (EERCs).

General Conformity focuses on a variety of emissions-producing sources including mobile and stationary sources, area, point, volume and line sources and construction sources whether operating on land, sea[165] or in the air. General Conformity covers most emission sources that would be affected by FAA Federal Actions.

The program establishes criteria and procedures for demonstrating whether general federal actions require a conformity determination, which is triggered by equaling or exceeding established *de minimis* threshold rates below which a federal action is not subject to General Conformity.[166] The program also fosters communications between federal agencies and state/local air quality agencies,[167] provides for public notification of and access to federal agency conformity determinations[168] and allows for air quality review of individual federal actions.[169]

The evaluation of General Conformity is the responsibility of each federal agency taking an action that is subject to conformity.[170] The EPA Office of Air Quality Planning and Standards (OAQPS) is responsible for management of the General Conformity program and can provide technical support and guidance.

8.1.3. Tribal Governments

Tribal governments also play an important role in implementing provisions of the CAA in their areas. If a tribe has the desire and capability to administer one or more CAA programs and meet certain criteria, the EPA can approve the tribe as eligible to implement CAA programs. The tribe can then develop and obtain approval of certain CAA programs from the EPA. Otherwise, the EPA usually implements the CAA provisions in Indian country. The EPA's Office of Air and Radiation (OAR) works closely with tribal governments and tribal environmental professionals, and provides training, grants, and technical support to increase their capacity to develop and manage their air quality programs.[171]

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[165] Refers to state waters adjacent to a nonattainment or maintenance area. State waters are considered part of the nonattainment or maintenance area extending from the shore, seaward to the State Seaward Boundary (SSB). The Submerged Lands Act of 1953 grants most coastal states rights out to three nautical miles (except 9 nautical miles for Texas, the Gulf Coast of Florida, and Puerto Rico).

[166] 40 CFR 93.153(b).

[167] 40 CFR 93.155.

[168] 40 CFR 93.156.

[169] Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements, 81 FR, 58010, 58124 (August 24, 2016) .

[170] *See* **Section 8.2.2** of this *Handbook*.

[171] EPA. *Clean Air Act Overview. "*Government partnerships to reduce air pollution." Available at https://www.epa.gov/clean-air-act-overview/government-partnerships-reduce-air-pollution.

8.2. Federal Actions

A general federal action either directly undertaken by a federal agency or requiring assistance from a federal agency for funding, approval or permitting may be subject to the requirement for preparation of a general conformity determination[172] to meet the requirements of section 176(c)(1) of the CAA.. Not all actions of federal agencies must undergo evaluation and preparation of a general conformity determination – in some cases, the action may satisfy an agency's "presumed to conform" list requirements[173] or an action may be otherwise exempt.[174] Where these methods of compliance with the section 176(c)(1) are not available, emissions of non-attainment or maintenance criteria pollutants associated with a federal project may require preparation of a general conformity determination.[175]

"Major federal actions"[176] under NEPA are generally associated with General Conformity. While the statutes are closely related in their purposes of bringing environmental considerations to bear in federal decision-making, the requirements under conformity are quite different from the procedures of NEPA.[177] One does not "trigger" the other or vice versa; they are independently applicable, with distinct purposes and applicability.[178]

However, due to the similarity of the definitions of the types of actions to which each statute applies, for purposes of this *Handbook*, the term "Federal Action" will refer to actions that require compliance with both the conformity obligations under the CAA and the procedural requirements of NEPA.

8.2.1. Cooperating Agencies

For various reasons, the preparation of a NEPA review may require the cooperation of multiple federal agencies, states, tribes or local agencies. This typically occurs when an entity other than the action agency has special expertise or jurisdiction related to environmental impacts of the Federal Action, or where a Federal Action falls under the authority of more than one federal agency and requires approvals from each.. These federal agencies, together with states, tribes, or local agencies, may agree to be "cooperating agencies" for purposes of conducting the NEPA review.

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[172] 40 CFR Part 93 Subpart B.

[173] Federal Presumed to Conform Actions Under General Conformity, 72 FR 41565 (July 30, 2007).

[174] 40 CFR 93.153(c)(2).

[175] 40 CFR 93.150(d)

[176] 40 CFR 1508.18.

[177] *See* Section 8.2.3 of this *Handbook*.

[178] *See* Section 8.2.3 *NEPA-General Conformity Connection* in this *Handbook.*

[179] Usually there is one agency designated as the "lead agency"[180] to supervise preparation of the environmental analysis on the behalf of all agencies, and the lead agency often oversees the conformity evaluation as well.

Throughout the NEPA process, the lead agency will collaborate, to the fullest extent possible, with all cooperating agencies concerning those issues relating to their specific jurisdiction and special expertise.[181]

In some cases, the FAA may need to provide assistance to another federal agency for that agency's action being reviewed under NEPA, where the other federal agency takes the lead. The FAA then, as a cooperating agency, is responsible for its own conformity evaluation of the Federal Action under FAA jurisdiction unless the cooperating agencies agree that the lead agency should prepare the conformity evaluation to cover emissions within the jurisdiction of the FAA. In such case, the lead agency would provide the FAA, as well as the other cooperating agencies, with the opportunity to provide input and review the draft conformity evaluation.

8.2.1.1. Responsibilities

Ensuring that emissions caused by a Federal Action will conform to the SIP is not the responsibility of the state or the EPA, nor are non-federal entities (*e.g.*, the airport authority or airport sponsor) responsible for ensuring conformity. However, non-federal entities, such as an airport authority or airport sponsor, along with the MPO, are responsible for cooperation in regional transportation planning, and have important roles in the conformity process by providing historical data and planning information needed to support a successful conformity evaluation.Each federal agency is solely responsible for deciding whether its actions are subject to conformity and has the affirmative responsibility to make its own conformity determination.

If required to make a conformity determination, the agency has the responsibility to meet all the requirements of the conformity provisions and ensure the action's emissions will conform to the SIP as required under CAA section 176(c)(1)(A) and (1)(B). The federal agency has the responsibility to ensure any reporting and public participation requirements are met.

Where more than one federal agency has authority to make a decision related a project being reviewed in a joint NEPA document, each cooperating agency that will issue a decision at the completion of the NEPA process is responsible for its own CAA conformity evaluation, where such an evaluation is required. The lead agency in the NEPA review would provide each cooperating agency with the opportunity to review

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[179] 40 CFR 1508.5. *Cooperating agency* means any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major federal action significantly affecting the quality of the human environment. The selection and responsibilities of a cooperating agency are described in 40 CFR 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a cooperating agency.

[180] 40 CFR 1508.16 *Lead agency* means the agency or agencies preparing or having taken primary responsibility for preparing the environmental impact statement.

[181] 43 CFR 46.230 "*Role of cooperating agencies in the NEPA process"* and 40 CFR 1501.6.

and offer input on the conformity evaluation. For proposed aviation actions, most agencies rely on the FAA to lead the NEPA review and prepare the conformity evaluation..

In some cases, the FAA may need to provide assistance to another federal agency for that agency's action being reviewed under NEPA, where the other federal agency takes the lead. The FAA then, as a cooperating agency, would be responsible for the conformity evaluation of its own activities that fall under FAA jurisdiction. In the alternative, the cooperating agencies may agree that the lead agency should prepare the conformity evaluation to cover emissions within the jurisdiction of the other agencies. In such case, the lead agency would provide the FAA, as well as the other cooperating agencies, with the opportunity to provide input and review the draft conformity evaluation.

8.2.2. NEPA-General Conformity Connection

A connection exists between the CAA conformity requirements and NEPA assessments, particularly for actions requiring environmental impact statements.[182] Both seek to protect human health and the environment from actions proposed by the federal government, and they are usually prepared concurrently because of their similar reporting and public participation requirements.

Federal Actions that require a NEPA assessment do not always require a conformity evaluation. However, nearly every conformity evaluation is associated with a NEPA review. This is because most NEPA actions involve some kind of construction or operational aspect that would cause emissions of the criteria or precursor pollutants to occur, and if the action would also cause such emissions to originate within a nonattainment area or maintenance area, conformity applies and, at a minimum, an applicability analysis is required.

While there are some similarities, the focus, purpose and intent of NEPA and General Conformity are different. NEPA is a procedural law that ensures that Federal agencies consider the environmental impacts of their actions and any alternatives in the decision-making process.[183] The federal agency will make a decision on which alternative will ultimately be approved for implementation. The CAA, on the other hand, and by extension conformity, is a substantive law that focuses on the NEPA alternative ultimately approved for implementation for the purpose of ensuring it will not interfere with states' rights and responsibilities to control air pollution in areas of their own jurisdiction, including attaining the NAAQS as expeditiously as possible. Thus, NEPA does not intend to mandate particular results or substantive outcomes as conformity does. Thus, General Conformity and NEPA, when combined with state and local air quality planning, provide the framework within which the states can attain and maintain the NAAQS.

Usually, the FAA can identify the preferred alternative early in the NEPA process and therefore, may limit the General Conformity process to that single alternative. However, it is not uncommon for the FAA to evaluate General Conformity for all the NEPA alternatives to

[182] Under the NEPA regulations (40 CFR 1500-1508), CEQ defines major federal actions which require the preparation of an Environmental Impact Statement.

[183] 40 CFR § 1500.1 Purpose and Policy.

ensure there is no delay in implementation of the Federal Action if the preferred alternative is not ultimately approved. The FAA prepares NEPA and the General Conformity evaluation in parallel because their reporting and public participation processes run along a similar timeline.

8.2.2.1. NEPA

NEPA's goals of informed decision-making and public involvement result in a legal mandate for a broader environmental evaluation than required under conformity, including evaluation of additional environmental resources and possibly a more expansive geographic area of study. NEPA considers the merit of several project alternatives, whereas conformity requires compliance only for the alternative that will be implemented. NEPA assesses the potential significant environmental effects of all project alternatives and requires the federal agency to disclose this information in a concise detailed statement (*i.e.,* EIS, EA or CatEx). When an agency prepares an EIS, the agency must undertake a public review process similar to that required for General Conformity.

8.2.2.2. General Conformity

General Conformity requires the federal agency to focus its attention just on the Federal Action the agency approves, or would approve in the agency's decision document and applies only to actions occurring within nonattainment or maintenance areas.

There are reporting and public review and comment requirements under General Conformity that are nearly the same as for the NEPA EIS determinations. When complete, documentation of the General Conformity evaluation may be appended to the NEPA document or presented in a separate document. While NEPA has a requirement to disclose the results of its analyses of environmental impact, but does not dictate results, under the Clean Air Act conformity provisions, if the agency cannot demonstrate that the project "conforms" to the SIP, the proposed action cannot go forward.

The remainder of this chapter presents the four parts of a General Conformity evaluation.

Part I—Actions Subject to General Conformity (**Section 8.3**);

Part II—Applicability Analysis (**Section 8.4**);

Part III—Demonstration, Draft Determination, Reporting and Public Participation (**Section 8.5**); and

Part IV—Final Determination, Reporting and Response to Comments (**Section 8.6**).

8.3. Part I—Actions Subject to General Conformity

Early in the planning process, the FAA should work with the project sponsor (*e.g.*, airport authority) and the local MPO to consider whether the Federal action will be subject to General Conformity requirements. In examining this question, the FAA must carefully consider the scope of its Federal Action, identify the affected nonattainment and maintenance areas and identify the relevant criteria and precursor pollutants for those areas.

8.3.1. Defining the Scope of the Federal Action

It is important to first have a thorough and accurate understanding of the scope of a Federal Action in order to determine whether the action is subject to the General Conformity regulations. Because applicability of general conformity requirements depends, in part, on whether the action takes place in a non-attainment or maintenance area, the general conformity applicability evaluation requires an examination of the affected environment identified in the NEPA process. The affected environment includes all the areas affected directly or indirectly by the action, which may not be limited to the immediate area that is the main focus of the action. The affected environment may need to be expanded to include, among other things, travel routes for employees and on-road construction equipment (*e.g.,* trucks hauling soil), staging areas for off-road construction equipment, and new sources of emissions or modified existing sources proposed in the action. The description of the affected environment needs to identify the county or multi-county air quality regions affected by the action[184] and determine the air quality status of the affected nonattainment or maintenance areas. Typically, the geographic scope established in the NEPA process for the "affected environment" will coincide with the geographic area where pollutant emissions caused by the Federal action originate. The emissions relevant to the analysis include direct emissions caused by the Federal action, and indirect emissions "(t)hat are caused or initiated by the Federal action and originate in the same nonattainment or maintenance area but occur at a different time or place as the action; (t)hat are reasonably foreseeable; (t)hat the agency can practically control; and (f)or which the agency has continuing program responsibility."

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Neither CAA section 176(c) nor the implementation regulations under General Conformity fully defines how to determine the scope of a Federal Action. In joint guidance on airport conformity issues, the FAA and the EPA advise that when a NEPA review is being prepared, the scope of the action for the purposes of conformity should mirror the scope of the Federal Action and at least the extent of the affected environment defined for the NEPA review—

> "*For airport development, if projects or actions are combined together for NEPA, then generally they should be kept together for General Conformity unless there are specific reasons to separate the projects or actions."*[186]

This guidance is supported by the EPA in its 1993 final rule[187] where, "*EPA believes that it is reasonable to expect that a conformity determination could be developed in parallel with the ongoing environmental analysis.*"

The issue is made more difficult when the decision of whether activities should be combined for the purposes of the NEPA review could affect project schedule, complexity and litigation

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184 40 CFR part 81 subpart C "Section 107 Attainment Status Designations."

185 *See Revisions to the General Conformity Regulations Final Rule*, 75 Fed. Reg. 17,254, 17,260 (April 5, 2010).

186 "General Conformity Guidance for Airports—Questions and Answers," Question #6, FAA and EPA (September 25, 2002).

187 58 FR 63214, 63216. November 30, 1993.

risk. As a result, airports will often benefit from expert advice from airport planners and counsel.[188]

8.3.2. Nonattainment Area and Maintenance Area Limitations

Conformity applies when emissions caused by a Federal Action would originate within a nonattainment or maintenance area.[189] However, certain limitations apply when determining whether Federal Actions in these areas are subject to conformity.[190]

8.3.2.1. Nonattainment Areas

A Federal Action proposed for a nonattainment area is not subject to conformity until 1 year after the effective date of the nonattainment designation, as provided for under CAA section 176(c)(6). This grace period applies to new or revised NAAQS under CAA sections 108 and 109, and to areas redesignated from attainment to nonattainment under CAA 107(d)(3).

The grace-period applies to a new/revised/redesignated nonattainment area for a particular NAAQS even though the area may be nonattainment or maintenance for multiple other NAAQS. Be aware that there might be multiple NAAQS for one criteria pollutant, with the same averaging times, but different levels (*i.e.*, concentrations) that are simultaneously in effect for a single nonattainment or maintenance area (*e.g.*, ozone has two 8-hour NAAQS, the 2008 standard for 0.075 ppm and the 2015 standard for 0.070 ppm; both might apply to the same nonattainment or maintenance area).

Sometimes ozone nonattainment areas are reclassified to a more protective classification ("bumped up" for instance from Moderate nonattainment to Serious nonattainment) due to the poor air quality conditions in the ozone nonattainment area that prevents the area from achieving the NAAQS by the regulatory attainment date. For instance, the EPA reclassified[191] a number of Moderate ozone nonattainment areas to Serious ozone nonattainment areas for the 2008 ozone 8-hour NAAQS when some areas failed to attain the NAAQS by the attainment date established by the EPA. This is an instance of reclassification, not redesignation. Therefore, the 1-year grace period does not apply to these reclassified areas.

8.3.2.2. Maintenance Areas

When a state requests the EPA to redesignate a nonattainment area to attainment because the NAAQS has been achieved, the state must provide certain revisions to its SIP to ensure attainment of the NAAQS throughout future years is maintained. Under CAA section 176(c)(6), the revision includes the submittal of a "maintenance plan,"

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188 Putnam, John E., and Ternieden, Claudio. 2005. *An Introduction to Airport Air Quality Law,*" 2nd ed. Kaplan Kirsch & Rockwell and the American Association of Airport Executives (AAAE).

189 Refer to Sections 2.2.3 and 2.2.4 of this *Handbook* for the meaning and purpose of nonattainment and maintenance areas.

190 *See* CAA section 176(c)(5)(B) and (c)(6).

191 Classifications apply only to ozone and PM nonattainment areas.

developed pursuant to CAA section 175A, that outlines the strategies and methods the state will use to maintain the NAAQS throughout a specified period of time. Such areas are referred to as "maintenance areas."[192]

The state is required to include, among other things, terms and conditions for emissions control measures in its CAA section 175A-approved maintenance plan, which would be in effect for a period of 10 years beyond the effective date that EPA approved redesignation of the area to attainment. Eight years into the maintenance plan, the state usually submits a second 10-year plan that ensures maintenance of the NAAQS for another 10 years beyond the first 10-year period. This creates a total maintenance period of 20 years. When the 20 years expire, the terms and conditions of the maintenance plan remain in full force and effect, even though General Conformity no longer applies, until the plan is removed by a subsequent EPA-approved SIP revision. If a SIP contains provisions to extend the 20-year expiration to a date beyond the 20 years, the applicability of conformity is extended as well.

Some states may choose the alternative to submit to EPA a revised slimmed down "limited maintenance plan" (LMP), which also must be approved by EPA under CAA section 175A. The option to develop a LMP is useful for maintenance areas that meet certain air quality conditions that will, with a high degree of probability, maintain the NAAQS 10 years into the future. It follows that future year emissions projections in these areas (*i.e.,* a Motor Vehicle Emissions Budget (MVEB)), and some of the standard analyses to determine Transportation Conformity with the SIP are no longer necessary.[193] In such areas, transportation plans, programs and projects are presumed to conform to the SIP.

EPA's General Conformity regulations, however, do not distinguish between maintenance areas with an approved "full" maintenance plan and those with an approved LMP. Thus, maintenance areas operating under an LMP are subject to the same General Conformity requirements as those covered by a full maintenance plan.

8.3.3. Criteria and Precursor Air Pollutants

The CAA requires the EPA to establish the NAAQS for six common air pollutants known as the "criteria pollutants," which are discussed in **Section 3.2** of this *Handbook*. General Conformity focuses on the criteria pollutants and their precursor pollutants, which are discussed in **Section 2.2.2** of this *Handbook*. When emissions of criteria or precursor pollutants are caused by a Federal Action and those emissions would not occur except for the implementation of the action, such emissions may be subject to General Conformity. Examples would include emissions from the use of construction equipment to build infrastructure and

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[192] The EPA designates areas as nonattainment, attainment or unclassified; an area is never "designated maintenance." A nonattainment area can be redesignated attainment if the area achieved the NAAQS and EPA approves a revised maintenance SIP, which is a maintenance plan developed and approved under CAA section 175A. As such, the area operates under a maintenance plan and is referred to as a "maintenance area."

[193] Approval and Promulgation of Air Quality Implementation Plans; State of Wyoming; Sheridan PM10 Nonattainment Area Limited Maintenance Plan and Redesignation Request, 83 FR 4015, 4016 (January 29, 2018

airfield areas; emissions from increased aircraft operations enabled by modified or new airfield pavement and increased operations due to more efficient arrival or departure procedures. All these activities could cause new emissions or decrease existing emissions in future years compared to what would occur under the action's "no-build" scenario of the same future year. The CAA conformity requirement applies to such emissions only when the emissions—

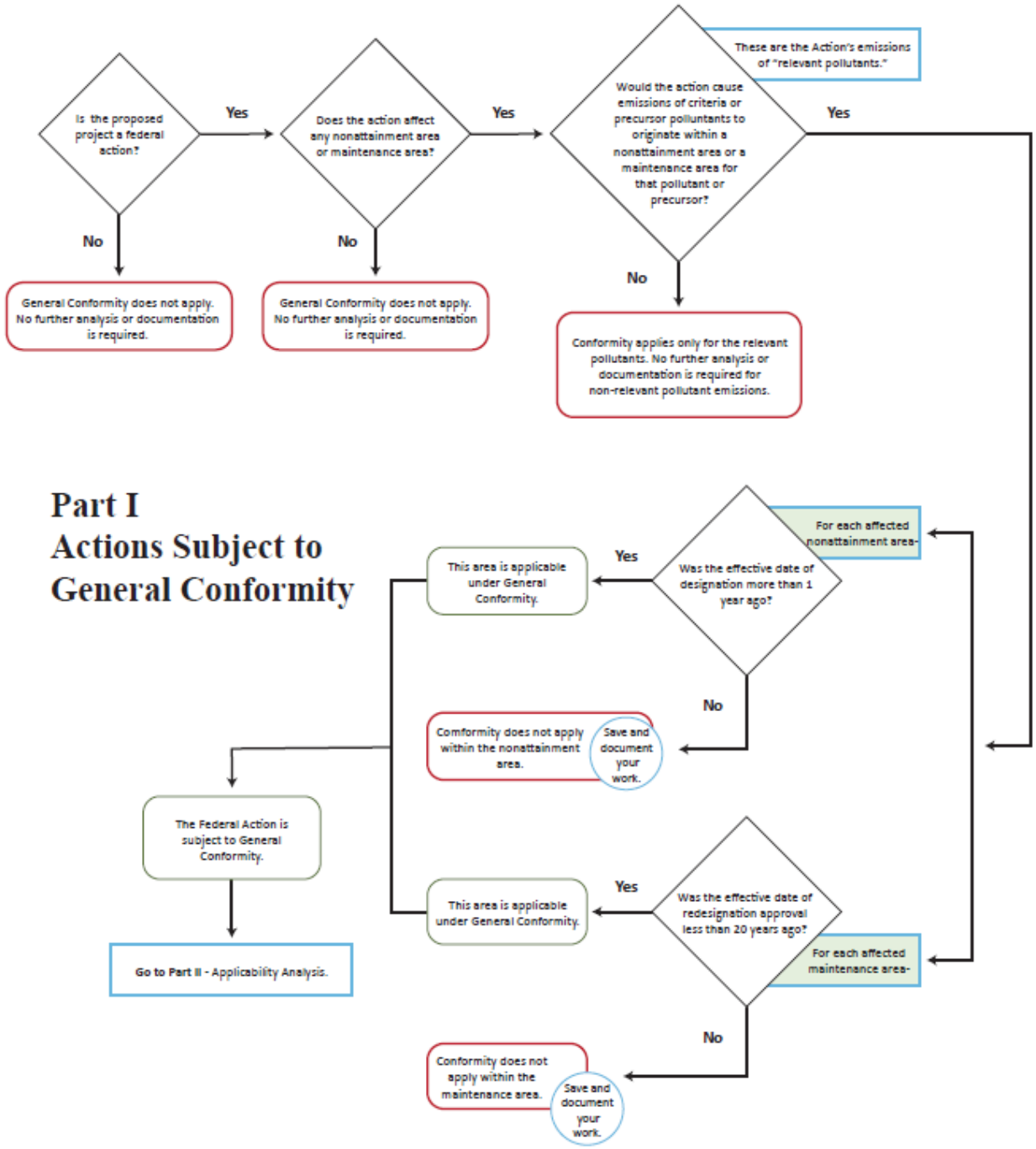
- Originate within a nonattainment or maintenance area; and
- Are pollutants for which the area was designated or approved nonattainment or maintenance; and includes the precursors of the criteria pollutants. These emissions define the "relevant pollutants."

For example, for an action proposed to occur within a $PM_{2.5}$ nonattainment or maintenance area, FAA would analyze emissions of $PM_{2.5}$ caused by the Federal Action and also emissions of the precursors that could lead to the secondary formation of $PM_{2.5}$ emissions, which are, NO_x, VOC, NH_3 and SO_2—collectively referred to as the relevant pollutants for a $PM_{2.5}$ nonattainment or maintenance area. Along with $PM_{2.5}$, ozone and NO_2 are the "secondary criteria pollutants," whereas the remaining criteria pollutants are the "directly emitted" pollutants and include, CO, SO_2, PM_{10} and lead.

8.3.4. Actions Subject to General Conformity Flowchart—Part I

The process to identify which general federal actions are subject to the conformity requirements is presented as a flowchart in **Figure 8-1 (**Part I—*Actions Subject to General Conformity*.

Figure 8-1. Part I—Actions subject to General Conformity



8.4. Part II—Applicability Analysis

Once a federal agency decides its action is subject to General Conformity, the next step is to prepare the applicability analysis. This will require an understanding of concepts such as exemptions, presumptions of conformity, excluded emissions, reasonably foreseeable emissions, the total of direct and indirect emissions and *de minimis* threshold rates. The purpose of the applicability analysis is to determine whether the Federal Action must be supported by a conformity determination.

8.4.1. Exemptions, Presumed to Conform Actions

The General Conformity regulations list several exempted and presumed to conform (PTC) activities (*i.e.,* parts or portions of an overall larger Federal Action) that the EPA determined are not subject to conformity. Such emissions would be excluded from the applicability analysis and would not require a conformity determination.

8.4.1.1. Exemptions

Exempt emissions are those which the federal agency is not required to include in the applicability analysis. Exempt actions are those the EPA accepts as conforming to the SIP based on probable reasonable evidence in the absence of proof to the contrary. Exempted emissions are caused by actions or parts of an action that would not result in any net emissions increase or would result in an increase that is clearly *de minimis*.[194] The EPA's list of exempt actions that might apply to FAA actions includes the seven activities listed in **Table 4-1**[195] of this *Handbook*.[196] Other exemptions are listed in 40 CFR 93.153.

8.4.1.2. Presumed to Conform Actions

A presumed to conform (PTC) action is presumed to meet the criteria for demonstrating conformity to the applicable SIP.[197] The presumption is based on an analysis that demonstrated how these actions, emissions or groups of actions would not cause emissions to equal or exceed the *de minimis* threshold rates given at 40 CFR 93.153(b)(1) and (b)(2) and would not require a conformity determination.

In addition to the list of PTC actions in the General Conformity regulations, the EPA allows federal agencies to create their own list of PTC actions so long as the conformity demonstration for each action or group of actions meets all the requirements of a PTC analysis in the regulations under 40 CFR 93.153. However, the number of these actions that can be applied to a single Federal Action may be limited. In 2007, the FAA published its own list in its final rule "Federal Presumed to Conform Actions under

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194 *See* Section 8.4.4 "*de minimis* Threshold Rates" in this *Handbook*.

195 *See* 72 Fed. Reg. 41565, 41567. July 30, 2007. Part II. *Existing Exemptions*.

196 Putnam, John E., and Ternieden, Claudio. 2005. An Introduction to Airport Air Quality Law (2nd ed.) Kaplan Kirsch & Rockwell LLC: Denver, Colorado.

197 CAA Section 176(c)(1)(A) and (1)(B).

General Conformity."[198] The list of FAA's PTC actions is provided in **Table 4-2** of this *Handbook*.

Note that even when an action would otherwise be presumed to conform or exempt, if EPA or a third party shows that emissions caused by the Federal Action should not have been presumed to conform and therefore would not meet the conformity requirements, the requirement to demonstrate conformity to the SIP will apply and the agency may need to conduct a new General Conformity evaluation.

8.4.1.3. Emissions Not Subject to General Conformity

The following emissions are not included in determining applicability of the General Conformity regulations and would be deducted from the project-related emissions being considered in the applicability analysis—

- Transportation-related emissions associated with the MPO's transportation plan;
- Emissions associated with a regionally significant transportation project that will be constructed by an entity that receives FHWA/FTA funding;
- Applied Airport Emissions Reduction Credits (AERCs) available through the FAA's VALE program; or
- Applied emissions included in the FAA's Early Emissions Reduction Credits (EERCs) that could be used for the action.

8.4.2. Reasonably Foreseeable Emissions

Emissions caused by the Federal Action must be considered reasonably foreseeable. There are two key parameters to consider relative to reasonable foreseeability—the timing and certainty of the emissions. Indirect emissions[199] become considerably less certain as they become separated in time and space from the Federal Action. The FAA has generally limited the consideration of indirect emissions at the point of 5 years following construction of a project. Special circumstances should be considered in setting this limit, but few emission sources can be reliably predicted well into the future. Similarly, subsequent state and local approvals could be speculative, and this would limit the ability to effectively predict emissions following a Federal Action. General Conformity does not require the use of "potential to emit" and the regulations do not allow for speculative estimates because such emissions are not reasonably foreseeable as defined under the General Conformity definition in 40 CFR 93.152.

8.4.3. Total of Direct and Indirect Emissions

The applicability analysis is based primarily on the calculation of the total of direct and indirect emissions and the identification of such emissions is not straight forward. The characterization of emissions as being direct or indirect is not precisely defined in the General Conformity

[198] 72 Fed. Reg. 41565, July 30, 2007.

[199] *See* **Section 8.4.3** of this chapter.

regulations; however, this topic is addressed in the *General Conformity Guidance for Airports Questions and Answers* dated September 25, 2002, and published by the EPA and the FAA. The following are definitions of direct and indirect emissions—

> *Direct Emissions - Direct emissions are those caused by or initiated by the implementation and/or operation of an action, and that occur at the same time and place as the action and must be reasonably foreseeable.*
>
> *Indirect Emissions - Indirect emissions are those caused by the implementation and/or operation of an action, are reasonably foreseeable, but which occur later in time and/or are farther removed in distance from the activity itself and occurs within the same nonattainment or maintenance area. Under General Conformity, indirect emissions are further limited to those emissions that the responsible Federal agency can "practicably control and will maintain control over due to a continuing program responsibility of the Federal agency."*

As an example, if a project includes a new runway and associated taxiways to accommodate additional aircraft traffic, the construction emissions caused by operation of the construction equipment would be categorized as direct emissions from the action. However, an increase in emissions due to aircraft operations, if the FAA expects this to occur, depends on first constructing the runway and taxiways and are also a projection that is dependent on airline choices. These operational emissions would typically be categorized as indirect emissions.

The direct and indirect emissions caused by the Federal Action would be projected for future years for comparison to the future projected emissions under the No-Build scenario. Usually, it is helpful to start with the year the action's emissions are greatest on an annual basis for each relevant pollutant. The projected emissions under the No-Action scenario would be subtracted from the Federal Action emissions for the same year. It is helpful to present this data in a table similar to **Table 6-2** in this *Handbook* for each future year and pollutant. The difference between the two sets of data is the "total of direct and indirect emissions," or "net emissions," for those future years. The net emissions are referred to in the General Conformity regulations under 40 CFR 93.152 as the "total of direct and indirect emissions"—

> *"Total of direct and indirect emissions means the sum of direct and indirect emissions increases and decreases caused by the federal action; i.e., the "net" emissions considering all direct and indirect emissions. The total of direct and indirect emissions includes the criteria pollutants and emissions of precursors of criteria pollutants."*

This analysis will reveal the year-to-year emissions increase or decrease caused by the Federal Action. The next step is to compare this data with the *de minimis* threshold rates applicable for the nonattainment or maintenance area affected by the Federal Action.

8.4.4. *de minimis* Threshold Rates

The *de minimis* threshold rates represent the emission rates below which a conformity determination is not required. The threshold rates vary by pollutant, by the severity of the

nonattainment status (*e.g.*, Serious, Severe, Moderate etc.), and in some cases by geographic location (*i.e.,* relative to the Ozone Transport Region states).[200]

The *de minimis* threshold rates are shown in **Table 8-1** *de minimis Threshold Rates for Nonattainment Areas*, and **Table 8-2** *de minimis Threshold Rates for Maintenance Areas*.

Table 8-1. *de minimis* Threshold Rates for Nonattainment Areas.

Criteria pollutants, classifications and precursors for Nonattainment Areas			***de minimis* Threshold Rates** (tons/year)								
			CO	**NH_3**	**NO_2**	**NO_x**	**Pb**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
CO			100	-	--	-	-	-	-	-	-
NO_2			-	-	100	100	-	-	-	-	-
O_3	Marginal and Moderate	Outside OTR	-	-	-	100	-	-	-	-	100
		Inside OTR	-	-	-	100	-	-	-	-	50
	Serious		-	-	-	50	-	-	-	-	50
	Severe		-	-	-	25	-	-	-	-	25
	Extreme		-	-	-	10	-	-	-	-	10
Pb			-	-	-	-	25	-	-	-	-
$PM_{2.5}$	Moderate		-	100	-	100	-	100	-	100	100
	Serious		-	70	-	70	-	70	-	70	70
PM_{10}	Moderate		-	-	-	-	-	-	100	-	-
	Serious		-	-	-	-	-	-	70	-	-
SO_2			-	-	-	-	-	-	-	100	-
Source: 40 CFR 93.153(b)(1). Notes: OTR = Ozone Transport Region.											

[200] The Ozone Transport Region (OTR) is an area of the contiguous U.S. where O_3 is transported long distances and across state and local jurisdictional boundaries. In this way, O_3 emissions from one area can significantly impact O_3 concentrations in an area substantially downwind. The OTR states are listed in CAA section 184.

Table 8-2. *de minimis* Thresholds in Maintenance Areas

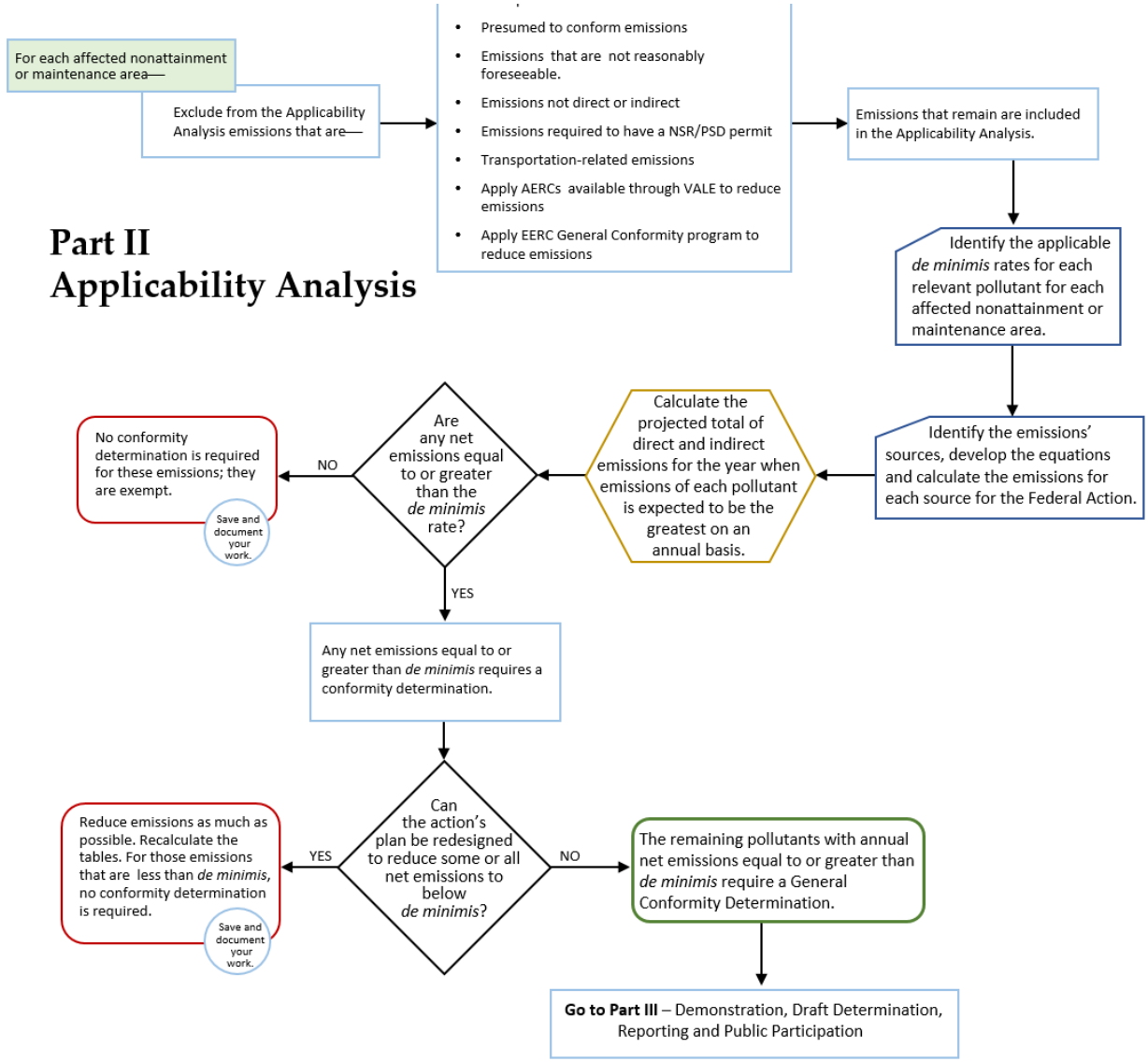
Criteria and precursors pollutants for Maintenance Areas		*de Minimis* Threshold Rates (tons/year)								
		CO	**NH_3**	**NO_2**	**NO_x**	**Pb**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
CO		100	-	-	-	-	-	-	-	-
NO_2		-	-	100	100	-	-	-	-	-
O_3	Outside OTR	-	-	-	100	-	-	-	-	100
	Inside OTR	-	-	-	100	-	-	-	-	50
Pb		-	-	-	-	25	-	-	-	-
$PM_{2.5}$		-	100	-	100	-	100	-	100	100
PM_{10}		-	-	-	-	-	-	100	-	-
SO_2		-	-	-	-	-	-	-	100	-
Source: 40 CFR 93.153(b)(2). Notes: OTR = Ozone Transport Region.										

Emissions caused by a Federal Action must be compared to the *de minimis* threshold rates applicable to the affected nonattainment and maintenance areas to determine whether the annual net emissions equal or exceed the rates. Emissions that equal or exceed the *de minimis* rates will require a conformity determination. Emissions that are less than *de minimis* are exempt, as described in **Section 8.4.1** of this *Handbook* and require no additional analysis. The agency should retain and document all calculations and information on which they based their conclusion of conformity due to *de minimis* emissions. There are some circumstances where the Federal Action could be redesigned to reduce the net emissions, if not to zero, at least to the lowest possible rate. If some reductions can be realized through a redesign, recalculate the total of direct and indirect emissions and compare them to the *de minimis* threshold rates. For those pollutants with emissions that continue to equal or exceed the threshold rates, prepare a demonstration of conformity upon which to base a draft conformity determination.

8.4.5. Applicability Analysis Flowchart—Part II

The procedures required to prepare the applicability analysis for a Federal Action is presented as a flowchart in **Figure 8-2 (***Part II Applicability Analysis)*.

Figure 8-2. Part II—Applicability Analysis



8.5. Part III–Demonstration, Draft Determination, Reporting and Public Participation

A conformity determination is needed when the annual net emissions of one or more relevant pollutants equals or exceeds the *de minimis* threshold rates. During this phase of the conformity evaluation, perform an analysis to demonstrate how the agency will ensure the annual net increases of relevant pollutants caused by the action will be reduced to zero or otherwise meet the conformity requirement under CAA 176(c)(1)(A) and (1)(B). The demonstration is required to show the reduction of emissions for every year and every pollutant where the *de minimis* rates were equaled or exceeded. Once the demonstration is complete and a draft conformity determination is prepared, the agency must meet all the reporting and public participation requirements of 40 CFR 93.155 and 93.156 for the draft conformity determination.

When the Federal Action requires a conformity determination under 40 CFR 93.153(b), there are several approaches (*i.e.,* criteria) that can be applied alone or in combination, as listed at 40 CFR 93.158, to demonstrate conformity. The procedures required for making the determination are listed at 40 CFR 93.159. It is important to remember that not all approaches may apply to a given situation. In either case, be aware that the Federal Action cannot be taken or started before the action is determined to conform to the SIP.

The annual net emissions of each relevant pollutant that equals or exceeds the *de minimis* rates, for any future year, require an independent analysis to demonstrate conformity whereby the net emissions increase must be reduced to zero net emissions or otherwise shown to conform (*e.g.*, through air quality modeling). If a determination is required for more than one nonattainment or maintenance area, each area will require a separate determination.

Key considerations in selecting the optimal approach depend on variables such as:

- Are the relevant pollutants directly emitted pollutants or are criteria pollutants formed by secondary formation?
- Are the emissions caused by this specific Federal Action accounted for in the SIP?
- Is there a SIP budget for emissions from construction? These are not necessarily project specific; consult with the state air agency.
- Does the SIP contain a baseline inventory of annual emissions of the relevant pollutants prepared when the area was first designated nonattainment or redesignated attainment (*i.e.,* maintenance area)?
- Does the SIP contain emissions targets for milestone dates?
- Is the SIP due to be revised due to failure to attain the NAAQS by the attainment date? If so, will the classification change?
- Is the state planning to or willing to revise the SIP?
- Are emissions offsets available in the region?
- What air quality model would be most appropriate if modeling is chosen?
- What meteorological data is available for the project area?

- Can background concentrations of the pollutants be established, which are needed for determining the design concentration values[201] that are then compared to the NAAQS to verify conformity?

The best approach is always project-specific and often is dependent on factors outside the control of the FAA or the airport, *e.g.*, the area's classification may be scheduled to be "bumped up" to a more severe classification because of the state's failure to attain the NAAQS by the regulatory attainment date,[202] which could change the *de minimis* rates that apply to a Federal Action. It should be noted that a marginal ozone nonattainment area may have no emissions budget in the SIP revision.

It is always best to coordinate early with the state air quality agency, the MPO and the EPA Regional office. There is a considerable amount of data interpretation that is required to correctly apply the demonstration criteria. The states' air quality agencies and MPOs are essential in providing a full understanding of the data, the current SIP and potential developments. It is important to note that when coordinating with the state air quality agency, conformity to the SIP means the Federal Action's emissions must conform to the purpose of the SIP and is not required to comply with all the SIP's specific methods or procedures for emissions reductions.

8.5.1. Years Analyzed

When a conformity determination is necessary to support the Federal Action, the analysis required to demonstrate conformity must reflect emission scenarios that are expected to occur within each of the following years—[203]

(1) The attainment year specified in the SIP, or if the SIP does not specify an attainment year, the latest possible attainment year allowed under the CAA; or
(2) The last year for which emissions are projected in the maintenance plan; and
(3) The year during which the total of direct and indirect emissions from the action is expected to be the greatest on an annual basis; and
(4) Any year for which the applicable SIP specifies an emissions budget as that term is defined in the General Conformity regulations.

Any one of these scenarios may be associated with multiple calendar years (*e.g.*, if a SIP specifies an emission budget in 3 different years) or multiple scenarios may occur in a single calendar year (*e.g.*, if a SIP's specified budget year is also the year of maximum net emissions). For these reasons, there is no specific number of years that need to be analyzed for a given Federal Action. Further, in determining the year of greatest net emissions increase for a relevant pollutant, the net emissions from multiple years may have to be calculated in order to determine which year has the greatest annual emissions increase for each relevant pollutant.

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[201] EPA Appendix W to 40 CFR part 51 "*Guideline on Air Quality Models*," section 9.2.2 "Design Concentration and Receptor Sites."

[202] Areas the EPA finds to have failed to attain the NAAQS by the regulatory attainment date are published in a Federal Register notice, "*Determination of Attainment by the Attainment Date*." Such areas may be "bumped up" to a more severe classification but do not qualify for the 1-year grace period allowed for newly designated nonattainment areas.

[203] 40 CFR 93.159(d).

8.5.2. Prepare the Draft Conformity Demonstration

Prepare an analytical demonstration of how the annual net increases of each relevant pollutant would be reduced to zero, describing all criteria and procedures that are used and providing copies of any written agreements or commitments for mitigation or offsets. It would be difficult to include in this guidance exactly how the demonstration should be prepared since all Federal Actions are unique. However, all such demonstrations should be documented with details of all strategies and methods used to reduce the emissions. Prepare a report that outlines the procedures and contains tables to organize the data.

If the agency chooses to perform air quality modeling to demonstrate conformity, the agency must be consistent with the techniques recommended in the latest version of Appendix W of 40 CFR part 51 (*i.e., Guideline on Air Quality Models*), and must document all input data, assumptions and solutions.

In the documentation for the conformity demonstration, the agency would identify which criteria under 40 CFR 93.158 the agency is claiming to demonstrate conformity, and ensure the procedures used are consistent with 40 CFR 93.159 through 93.165, as appropriate. The agency would retain all records documenting the preparation of the demonstration, including calculations and information sufficient that the quantification can be verified by a third party.

8.5.3. Prepare the Draft Conformity Determination

Based on the applicability analysis and the conformity demonstration, prepare the written draft conformity determination. Ensure the determination states clearly how the action's emissions meet the conformity requirements under CAA section 176(c)(1)(A) and (1)(B) and attach all documentation.

8.5.4.Reporting Requirements for the Draft Conformity Determination

The agency must meet all the reporting requirements under 40 CFR 93.155 for the draft conformity determination. The agency must provide a 30-day notice that describes the Federal Action and the agency's draft determination, as required under 40 CFR 93.155(a). Distribute the notice to all relevant federal, state and local air quality agencies, and where applicable, notify the affected federally recognized Indian tribal government and affected Federal Land Manager. In addition, notify the offices listed in CAA section 174, if applicable, and the MPO.[204]

8.5.5. Public Participation Requirements for the Draft Conformity Determination

The agency must meet all the public participation requirements under 40 CFR 93.156 for the draft conformity determination.

[204] For any ozone, CO or PM_{10} nonattainment area, the offices receiving the 30-day notice would include those listed in CAA section 174(a), which relates to planning procedures for SIPs.

Under 40 CFR 93.156(a), upon request by any person, make available for review the draft determination, including supporting documentation that describes the analytical methods and conclusions relied upon in making the applicability analysis and draft determination.

Under 40 CFR 93.156(b), the agency must make public its draft conformity determination and provide a 30-day period for public review and to receive their written comments. The agency must retain the comments for documentation and prepare written responses to the comments. This comment period may occur concurrently with other public involvement, such as it may occur in the NEPA process. The public participation requirements must be met before any formal action is taken on the draft determination.

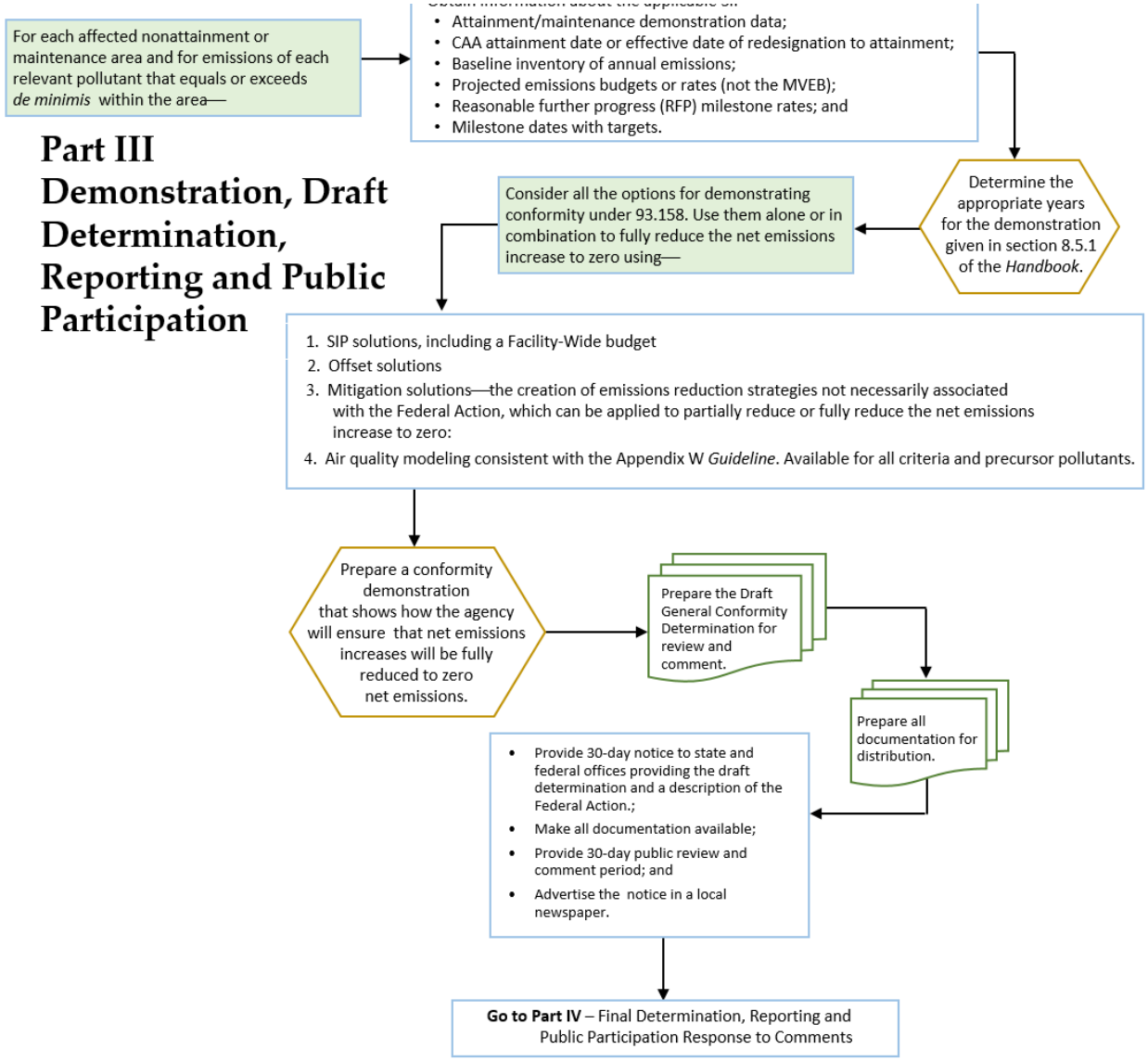
In addition, under 40 CFR 93.156(b), the agency must place a notice by prominent advertisement in a daily newspaper of general circulation in the area affected by the action. If the action would have multi-regional or national impacts, the agency could, as an alternative, publish the notice in the Federal Register.

Under 40 CFR 93.156(a), the agency must, upon request by any person, make available the comments and its responses to the comments.

8.5.6. Demonstration, Draft Determination, Reporting and Public Participation Flowchart—Part III

The process for demonstrating and preparing the draft conformity determination, and meeting the reporting and public participation requirements, are presented as a flowchart in **Figure 8-3** (*Part III—Demonstration, draft determination, reporting and public participation)*.

Figure 8-3. Part III—Demonstration, Draft Determination, Reporting and Public Participation



8.6. Part IV—Final Determination, Reporting and Response to Comments

During this final phase of the conformity evaluation, the agency would prepare the final conformity determination, ensuring all comments received on the draft determination have written responses and meet the reporting requirements as given in 40 CFR 93.155 for the final determination.

8.6.1. Prepare the Final Conformity Determination

The agency would prepare the final conformity determination based upon the draft determination and after considering comments from any interested parties, as directed under 40 CFR 93.154. Ensure the determination states clearly how the action's emissions meet the conformity requirements under CAA section 176(c)(1)(A) and (1)(B).

8.6.2. Reporting Requirements for the Final Conformity Determination

The agency must meet all the reporting requirements under 40 CFR 93.155(b) for the final conformity determination. Within 30 days after making the final conformity determination the agency must notify all relevant federal, state and local air quality agencies, and where applicable, notify the affected federally recognized Indian tribal government and affected Federal Land Manager, and the MPO.

8.6.3. Public Participation Response to Comments for the Final Conformity Determination

The federal agency must meet all the public participation requirements under 40 CFR 93.156 for the final conformity determination. Under 40 CFR 93.156(c), the agency must document its responses to all the comments received on its draft conformity determination and make the material available upon request by any person within 30 days of the final conformity determination.

Under 40 CFR 93.156(d), the agency must, within 30 days of the final determination, make public its final determination by placing a notice by prominent advertisement in a daily newspaper of general circulation in the area affected by the action. If the action would have multi-regional or national impacts, the agency, as an alternative, can publish the notice in the Federal Register.

8.6.4. Final Determination, Reporting and Public Participation Response to Comments Flowchart—Part IV

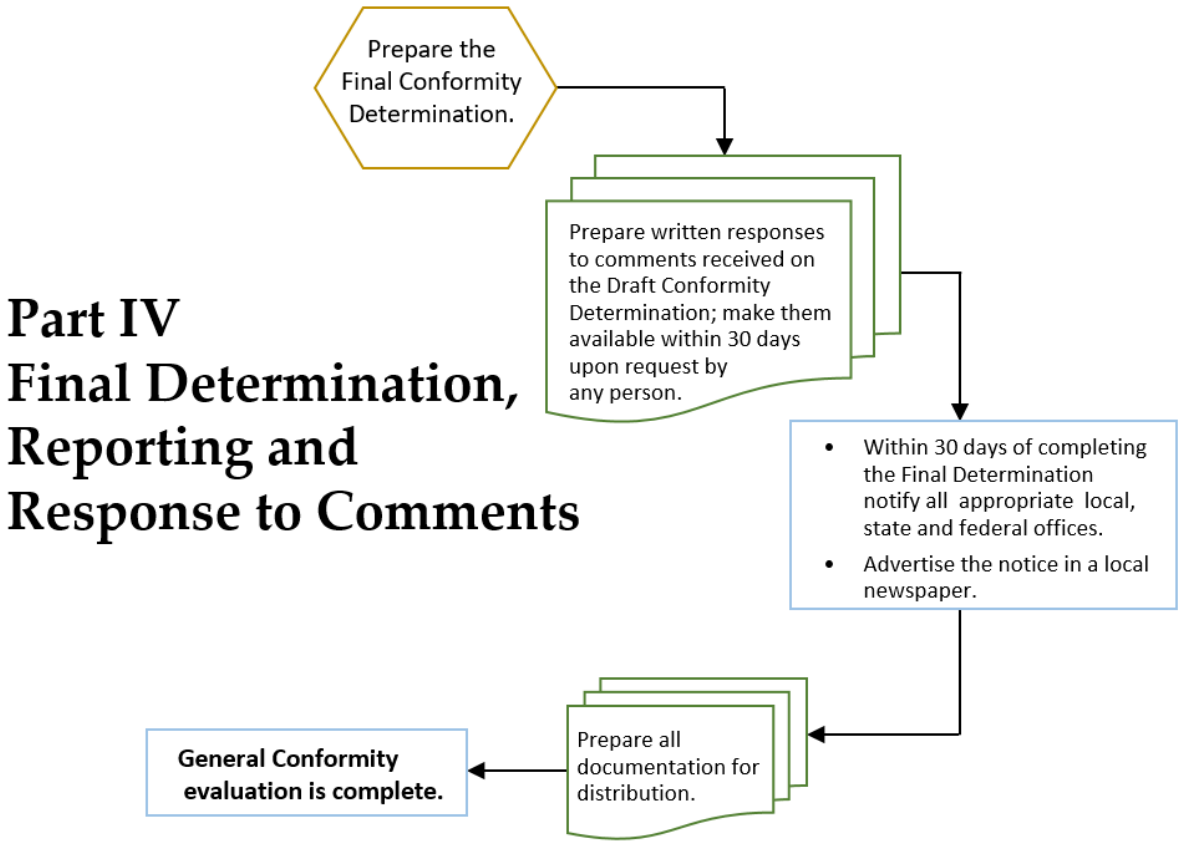
The process for preparing the final conformity determination and meeting the reporting and public participation requirements are presented as a flowchart in **Figure 8-4 (**Part IV—*Final determination, reporting and response to comments).*

8.7. Confidential Business Information Exclusions

Under 40 CFR 93.155(c) and 93.156(e), the draft and final conformity determinations shall exclude any restricted information or confidential business information. The disclosure of restricted information and confidential business information shall be controlled by the applicable

laws, regulations, security manuals, or executive orders concerning the use, access, and release of such materials. Subject to applicable procedures to protect restricted information from public disclosure, any information or materials excluded from the draft or final conformity determination or supporting materials may be made available in a restricted information annex to the determination for review by Federal and State representatives who have received appropriate clearances to review the information.

Figure 8-4. Part IV—Final determination, reporting and response to comments



9. Coordination Best Practices

This section discusses the opportunities, objectives, and methods of conducting agency coordination in support of the air quality assessment process. Such coordination between the FAA, the reviewing agencies, and other stakeholders will help foster a common understanding for how to meet the goals of the assessment and will help to avoid unnecessary delays and setbacks. For the purposes of this discussion, three common methods for conducting this coordination are addressed: (i) the Scoping Process, (ii) the Air Quality Assessment Protocol, and (iii) the Coordination and Review Process.

9.1. Scoping Process

Under NEPA, "scoping" is an early and open process for determining the scope of issues to be addressed in a NEPA document and for identifying the significant issues related to a Federal Action. Typically, the responsible FAA official (as defined in FAA Order 1050.1) takes the lead in the scoping process, inviting the participation of affected federal, state, local, and tribal agencies and any other interested persons. Although there is no standard approach to scoping, it is also common that scoping facilitates public participation in the process. If appropriate, a scoping meeting(s) is/are held to collect feedback from agencies and the public. Consultation with appropriate agencies having jurisdiction by regulation or special expertise is usually initiated prior to or upon initiation of the scoping process as well.

In the case of air quality, scoping provides an opportunity for reviewing agencies and the public to submit comments and provide suggestions on the overall scope of the assessment, including the analysis methods, the communication of the results, and any other particular concerns or expectations among the respondents.

9.2. Air Quality Assessment Protocol

Another useful means of enhancing agency coordination is the development and application of an "Air Quality Assessment Protocol." The overall purpose of the protocol is to document the scope, establish the endpoints, and resolve any areas of uncertainty regarding the assessment prior to its undertaking. An example of the contents of such a protocol follows:

- *Project Description* – This section provides a general overview of the purpose and scope of the Federal Action, including the alternatives.
- *Regulatory Setting* – This section provides information pertaining to regulatory conditions in the project area. For example, information on attainment/nonattainment designations, SIPs, and applicable regulatory criteria and/or thresholds that will be applied to the results of the air quality assessment can be included.
- *Air Quality Assessment* – This section describes the overall approach, specific methodologies and models, data sources and assumptions, and other supporting information that will be used in conducting the air quality assessment.
- *Presentation of Results* – This section describes how the results of the assessment will be presented including the endpoints of the technical analyses.

- *Supplemental Information* – This material includes (but is not necessarily limited to) information pertaining to General and Transportation Conformity, HAPs and GHGs, and any other technical information to be collected and/or developed in support of the air quality assessment.

Once the protocol document has been reviewed and agreed upon by the various stakeholders, the FAA should obtain acknowledgements from the agencies consulted that the air quality protocol is acceptable to them, and the work completed.

9.3. Coordination and Review Process

Agency coordination and review is the final step in addressing any comments or concerns prior to documenting the results and moving forward with the Federal Action. The public comment and review aspects of general conformity (40 CFR 93.156) can be concurrently completed with public involvement associated with the NEPA process, provided the requirements of both are fully satisfied.

FAA is singularly responsible for the air quality reviews of the Federal Action. FAA may rely on technical analysis prepared by applicants, and applicants are encouraged to work with air quality agencies to ensure their plans are reflected in the SIP. However, the actual agency coordination for a Federal Action is an FAA responsibility.

References

This section contains a listing of the guidance, regulations, manuals, and other documents referred to in this Handbook.

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Glossary

This section discusses basic terms and definitions used in assessing the air quality impacts from FAA actions.

Above Ground Level (AGL) - Height above ground elevation.

Affected Environment - The section of an environmental document that succinctly describes the environmental conditions of the potentially affected geographic area or areas.

Air Quality - Ambient pollutant concentrations and their temporal and spatial distribution.

Air Quality Database - A collection of information on the ambient air quality that existed within an area during a particular time period. This data is usually collected and published by the State Air Pollution Control Agency.

Air Quality Model - An algorithmic relationship between pollutant emissions and pollutant concentrations used in the prediction of a project's pollutant impact.

Air Quality Monitor - A device for measuring pollutant concentrations. One such device is a Non-Dispersed Infrared Analyzer used to record carbon monoxide concentrations.

Air Quality Standard - A legal requirement for air quality, usually expressed in terms of maximum allowable pollutant concentration, averaged over a specified interval.

Ambient Concentrations - Initial concentration sensed/measured at a monitoring/ sampling site.

Ambient Monitoring - Systematic measurements of characteristics (e.g., pollutant concentration and wind velocity) of the air at a fixed location.

Area Source - In air quality modeling the agglomeration of many sources that have low emission rates spread over a large area that are too numerous to treat individually. An example of this type of source would be a parking lot.

Atmospheric Stability - The resistance to or enhancement of vertical air movement related to vertical temperature profile.

Attainment Area - An area that meets NAAQS for a particular pollutant.

Auxiliary Power Units (APUs) - On-board engines that supply power to an aircraft while taxing and parked at the gate when the main engines are off.

Averaging Time - A period over which measurements of air quality parameters are taken. Air quality standards are specified for averaging times of one, three, eight, and twenty four hours, as well as one year.

Aviation Environmental Design Tool (AEDT) - A software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise.

Background Concentration - Pollutant concentrations due to (i) natural sources, (ii) nearby sources other than the one(s) currently under consideration and (iii) unidentified sources.

Calm - For purpose of air quality modeling, calm is used to define the situation when the wind is indeterminate with regard to speed or direction.

Carbon Dioxide (CO_2) - The most prevalent GHG emitted when burning carbon-based fuels.

Carbon Monoxide (CO) - A colorless, odorless, toxic gas produced by the incomplete combustion of organic materials used as fuels. CO is emitted as a byproduct of essentially all combustion. Idling and low speed mobile source operations, such as aircraft taxiing are the most prevalent CO emission sources commonly found at airports.

Categorical Exclusion (CATEX) - Categories of actions that do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect. See 40 C.F.R. Section 1508.4. Note: A categorically excluded action is NOT eligible to be categorically excluded if extraordinary circumstances exist that may cause a significant environmental effect. Extraordinary circumstances are factors or circumstances that raise the potential for a proposed action included in a CATEX to have a significant environmental impact and therefore require further analysis in an EA or an EIS (see Paragraph 5-2 of FAA Order 1050.1F and CEQ 40 CFR 1508.4).

Clean Air Act (CAA) - The Federal law regulating air quality. The first CAA, passed in 1967, required that air quality criteria necessary to protect the public health and welfare be developed. Since 1967, there have been several revisions to the CAA. The CAA Amendments (CAAA) of 1990 represent the fifth major effort to address clean air legislation.

Clean Air Act Amendments of 1990 (CAAA) - The CAAA of 1990 represent the fifth major effort to address clean air legislation. Revisions include significant strengthening of CAA, especially by adding detailed requirements for federal actions to conform to State Implementation Plans (SIP), expanding the list of hazardous air pollutants from eight to 189, and strengthening the operating permit program.

Code of Federal Regulations (CFR) - An annual codification of the general and permanent rules published in the Federal Register (FR) by the executive departments and agencies of the federal government of the U.S.

Conformity - The act of meeting Section 176(c)(l) of the CAAA that requires federal actions to conform to the SIP for air quality. The action may not increase the severity of an existing violation nor can it delay attainment of any standards.

Conformity Requirement - CAA section 176(c) that ensures that federal actions conform to the purpose of the applicable implementation plan for the control and prevention of air pollution within nonattainment areas and maintenance areas. In order to meet this CAA requirement, Federal agencies must demonstrate that the actions they approve, permit or fund will not cause a new violation of an air quality standard, increase the frequency or severity of any existing violations of any air quality standard, or delay timely attainment of any air quality standard.

Construction Emissions - Emissions generated by construction activities and/or equipment that may have substantial temporary impact on local air quality.

Control - The ability to regulate, in some way, the emissions from a federal action. The ability to regulate can be demonstrated directly through the use of emissions control equipment on a boiler or indirectly through the implementation of regulation or conditions in the nature of activity that must be established in permits of approvals or by design of the action. An example of indirect control is limiting vehicle emissions by controlling the size of a parking facility.

Control Strategy - A combination of limiting measures designed to achieve the aggregate reduction of emissions.

Cooperating Agency - A cooperating agency may be any Federal agency that has jurisdiction by law or special expertise with respect to any potential environment impact involved in a proposal for legislation or federal action that significantly affects the quality of the human environment. A cooperating agency may also be a state or local agency of similar qualifications or, when the effects influence a reservation, an Indian Tribe. By agreement with the lead agency, an Indian Tribe may become a cooperating agency.

Criteria Pollutants - The six pollutants listed in the CAA that are regulated by the EPA through the NAAQS because of their health and/or environmental effects. They are: nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM) which is segregated into two size ranges: equal to or less than 10 microns in diameter (PM_{10}) and equal to or less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb).

***de minimis* -** If an action has *de minimis* emissions (Conformity Rule 40 CFR 93.153c), then a conformity determination pursuant to the CAA of 1990 is not required.

Design Concentration Value – The design concentration value is compared to the NAAQS to confirm conformity to the SIP. The value is the combination of the background concentration with the estimated modeled impact of the proposed action at modeling receptor locations. Appendix W of 40 CFR part 51, section 9.2.2(a)(i).

Direct Effect - An effect that is caused by the implementation and/or operation of an action that occurs at the same time and place. These type of effects are also often referred to as primary effects.

Direct Emissions - Direct emissions are those caused by or initiated by the implementation and/or operation of an action, and that occur at the same time and place as the action and must be reasonably forseeable.

Dispersion - The process by which atmospheric pollutants disseminate due to wind and vertical stability.

Emission Factor - The rate at which pollutants are emitted into the atmosphere by one source or a combination of sources.

Emissions Inventory - A complete list of sources and rates of pollutant emissions within a specific area and time interval.

Emissions and Dispersion Modeling System (EDMS) - A model designed to assess the air quality impacts of airport emission sources, particularly aviation sources, which consist of: aircraft, APUs, GSE, ground access vehicles, and stationary sources.

Environmental Assessment (EA) - A concise public document that provides sufficient data, evidence, and analysis to determine if Federal agency should prepare an EIS for an action or issue a FONSI (see Chapter 3 of FAA Order 1050.1F). An EA is not necessary in cases where the Federal agency has decided to prepare an EIS. An EA can be prepared at any time to aid agency decision making.

Environmental Impact Statement (EIS) - An EIS is a detailed, concise public document required for major federal actions likely to have significant effects on the human environment. The document may be directly prepared, without first doing an EA, if the action will have significant environmental impacts. An EIS provides the public and decision makers with clear, written documentation of potential significant environmental effects of the proposed action, and reasonable alternatives including the no action alternative.

Finding of No Significant Impact (FONSI) - A FONSI is a document which briefly presents evidence of why Federal agency has determined that a proposed action, not otherwise categorically excluded, will not have a significant impact on the environment (see paragraph 6-3 of FAA Order 1050.1F). The FONSI justifies why the preparation of an EIS is unnecessary. The FONSI must include the EA or be attached to the EA, or a summary of it, and reference any other associated environmental documents. The FONSI should state all mitigation that will be undertaken, if any.

Fluorinated Gases - There are three main categories of fluorinated gases -hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). These are synthetic, powerful greenhouse gases (GHGs) that have no natural sources and only come from human-related activities and are emitted through a variety of industrial processes.

Fugitive Dust - Dust discharged to the atmosphere in an unconfined flow stream such as that from unpaved road, storage piles and heavy construction operations.

General Aviation (GA) - The operation of civilian aircraft for purposes other than commercial passenger transport, including personal, business, and instructional flying.

General Conformity Regulations - Rule that ensures that federal actions comply with the NAAQS. In order to meet this CAA requirement, a Federal agency must demonstrate that every action that it undertakes, approves, permits or funds will conform to the appropriate SIP.

Greenhouse Effect - Trapping and build-up of heat in the atmosphere (troposphere) near the earth's surface. Some of the heat flowing back toward space from the earth's surface is absorbed by water vapor, carbon dioxide, ozone, and several other gases in the atmosphere and then reradiated back toward the earth's surface. If the atmospheric concentrations of these greenhouse gases rise, the average temperature of the lower atmosphere will gradually increase.

Greenhouse Gases (GHGs) - Gases that trap heat in the atmosphere. The most prevalent GHGs are CO_2, methane (CH_4), and nitrous oxide (N_2O), and fluorinated gases.

Ground Access Vehicle - Encompass motor vehicles traveling on- and off-airport roadways, within airport parking facilities, and idling along terminal curbsides (e.g., private autos, taxis/limos, shuttles, vans, buses, rental cars, etc.). Ground access vehicles exclude those GSE used for servicing the aircraft and airport.

Ground Power Unit (GPU) - Provides electrical power to aircraft during ground time.

Ground Support Equipment (GSE) - On-site airport vehicles and equipment designed to service aircraft while parked at the gate or when operating in the terminal area (e.g., baggage tugs, belt loaders, etc.).

Hazardous Air Pollutants (HAPs) - Under the federal CAA and its amendments, the EPA has initially identified 188 air pollutants that meet the definition and are regulated under Section 112 (*Toxic Air Pollutants*) of the act. These include a wide variety of organic and inorganic chemicals and compounds.

Heavy Metals - Metallic elements of relatively high density, or of high relative atomic weights; (e.g. mercury, chromium, cadmium, arsenic, and lead).

Hot-Spot Analysis - an estimation of likely future localized CO, PM_{10}, and/or $PM_{2.5}$ pollutant concentrations and a comparison of those concentrations to the NAAQS.

Hydrocarbons (HC) - Total hydrocarbons excluding CH_4 and ethane. These gases represent unburned and wasted fuel. They come from incomplete combustion of gasoline and from evaporation of petroleum fuels.

Indirect Control - Control of air quality by altering activities that influence the rate and distribution of emissions (e.g., traffic patterns, land use). Indirect control contrasts with direct control at the source of emissions (e.g., devices on automobiles or smoke stacks).

Indirect Effect - Effects that are caused by the implementation and/or operation of an action, that occur later in time or are further removed by distance from the action, but which are still reasonable foreseeable. Often referred to as secondary effects.

Indirect Emissions - Indirect emissions are those caused by the implementation and/or operation of an action, are reasonably foreseeable, but which originate in the same nonattainment or maintenance area but occur at a different time or place as the action. Under General Conformity, indirect emissions are further limited to those indirect emissions that the responsible Federal agency can "practicably control and will maintain control over due to a continuing program responsibility of the Federal agency."

Indirect Source - Any structure or installation which attracts an activity which creates emission of pollutants. For example, a shopping center, an airport or a stadium.

Integrated Noise Model (INM) - A computer model that evaluates aircraft noise impacts in the vicinity of airports.

Inventory - See "Emissions Inventory."

Inversion - A thermal gradient created by warm air situated above cooler air. An inversion suppresses turbulent mixing and thus limits the upward dispersion of polluted air.

Landing and Takeoff (LTO) - LTO refers to an aircraft's landing and takeoff cycle. One aircraft LTO is equivalent to two aircraft operations (one landing and one takeoff). The standard L TO cycle begins when the aircraft crosses into the mixing zone as it approaches the airport on its descent from cruising altitude, lands and taxis to the gate. The cycle continues as the aircraft taxis back out to the runway for takeoff and climbout as its heads out of the mixing zone and back up to cruising altitude. The five specific operating modes in a standard LTO are: approach, taxi/idle-in, taxi/idle-out, takeoff, and climbout. Most aircraft go through this sequence during a complete standard operating cycle.

Lead (Pb) - A heavy metal that, when ingested or inhaled, affects the blood forming organs, kidneys and the nervous system. The chief source of this pollutant at airports is the combustion of leaded aviation gasoline in piston-engine aircraft.

Lead Agency - The agency preparing or having taken primary responsibility for preparing the EIS.

Level-of-Service (LOS) - LOS ratings measure the operating conditions at the intersection and how these conditions affect traffic volume, signal timing, and related congestion delays. There are six LOS rankings: LOS A through LOS F. LOS A is the highest ranking relating to delays of less than 10 seconds per vehicle. LOS F is the lowest, describing operations with delays greater than 80 seconds per vehicle.

Line Source - In air quality modeling a long, narrow source of emissions such as roadway or runway.

Maintenance Area - Any geographic area of the U.S. previously designated nonattainment pursuant the CAA Amendments of 1990 and subsequently redesignated to attainment.

Major Federal Action - Actions with effects that may be major and potentially subject to Federal control and responsibility. Federal actions tend to fall into four categories: adoption of official policy, adoption of formal plans, adoption of programs and approval of projects, whether approved by permit or other regulatory decision. See 40 CFR 1508.16 for additional information.

Methane (CH_4) - Methane is the second most prevalent GHG, emitted from industry, agriculture, and waste management activities.

Microscale - Small scale analysis involving distances up to approximately one kilometer and averaging times up to several tens of minutes.

Mitigation - This term is defined in 40 CFR 1508.20. It includes: (i) avoiding the impact altogether by not taking a certain action or parts of an action or finding a new site; (ii) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (iii) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (iv) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (v) compensating for the impact by replacing or providing substitute resources or environments.

Mixing Height - The height of the completely mixed portion of atmosphere that begins at the earth's surface and extends to a few thousand feet overhead where the atmosphere becomes fairly stable. See also "inversion".

Mobile Source - A moving vehicle that emits pollutants. Such sources include airplanes, automobiles, trucks, and ground support equipment.

Mobile Source Air Toxics (MSATs) - Mobile source air toxics are compounds emitted from highway vehicles and nonroad equipment which are known or suspected to cause cancer or other serious health and environmental effects. Mobile sources are responsible for direct emissions of air toxics and contribute to precursor emissions which react to form secondary pollutants. Examples of mobile source air toxics include benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, polycyclic organic matter (POM), naphthalene, and diesel PM.

Modal Emissions Factors - Vehicular emissions factors for individual modes of operation. For aircraft, these modes are takeoff, climbout, approach, and taxi.

Model - A quantitative or mathematical representation or simulation which attempts to describe the characteristics or relationships of physical events.

Monitoring Site - A location of a measurement device in a monitoring network.

NAAQS Assessment - For the purpose of this *Handbook*, this refers to the use of an air quality model to predict ambient concentrations of air pollutants and the comparison of these results to the NAAQS.

National Ambient Air Quality Standard (NAAQS) - Air Quality standards established by the EPA to protect human health (primary standards) and to protect property and aesthetics (secondary standards).

National Environmental Policy Act (NEPA) - An Act established "…to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and

stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality." [42 USC § 4321 - *Congressional declaration of purpose*] NEPA requires federal agencies to analyze the impacts of major federal actions on the human environment both to aid in decision-making and to disclose those impacts to the public.

Nitric oxide (NO) - Also known as nitrogen monoxide, is a by-product of combustion of substances in the air, as in automobile engines, fossil fuel power plants, and is produced naturally during the electrical discharges of lightning in thunderstorms.

Nitrogen Dioxide (NO_2) - The two most prevalent oxides of nitrogen (NO_x) are nitrogen dioxide (NO_2) and nitric oxide (NO). Both are toxic gases with NO_2 being a highly reactive oxidant and corrosive. NO_2 is an odorless gas that acts mainly as an irritant affecting the mucosa of the eyes, nose, throat, and respiratory tract. Extremely high-dose exposure (as in a building fire) to NO_2 may result in pulmonary edema and diffuse lung injury.

Nitrogen Oxides (NO_x) - A poisonous and highly reactive gas produced when fuel is burned at high temperatures causing some of the abundant nitrogen in the air to bum also. At airports this pollutant is emitted by automobiles, aircraft engines, electric power plants, and other combustion equipment. Takeoff and climbout are the significant NO_2 producing modes of aircraft operation.

Noise Integrated Routing System (NIRS) - A noise-assessment program designed to provide an analysis of air traffic changes over broad areas. It is intended to work in conjunction with other Air Traffic modeling systems that provide the source of routes, events, and Air Traffic procedures such as altitude restrictions.

Nonattainment Area - Any geographic area of the U.S. that is in violation of any NAAQS and therefore has been designated as nonattainment under the CAA.

Non-methane OG (NMOG) - As implied, NMOGs include all organic compounds except CH_4 which is the most common OG and a greenhouse gas that is sometimes excluded from the assessment/analysis of organic compounds.

NONROAD Model - Model that estimates air pollutants from non-road engines, equipment, and vehicles.

Notice of Intent (NOI) - A brief notice placed in the *Federal Register* by the Federal agency noting that the agency will prepare an EIS. The NOI describes the proposed action and possible alternatives, details the proposed scoping process (i.e., location and time of meetings), and provides the name and address of a point of contact within the Federal agency to answer questions about the proposed action and the EIS.

Ozone (O_3) - A colorless, toxic gas formed by the photochemical reactions in the atmosphere of VOCs with the oxides of nitrogen. Ozone commonly is referred as "Smog." Ozone is not emitted directly by any airport.

Particulate Matter (PM) - Also known as "particle pollution," is made up of a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope. Particle pollution includes "inhalable particles," with diameters larger than 2.5 micrometers and smaller than 10 micrometers (PM_{10}) and "fine particles," with diameters that are 2.5 micrometers and smaller (i.e., $PM_{2.5}$).

Plume - The spreading pollutants emitted by a fixed source such as a smokestack or an exhaust and released into the atmosphere.

PM_{10} - a criteria pollutant for which there are NAAQS and represents the category of particulates categorized as "coarse" PM (i.e., with an aerodynamic diameter of 10 microns or less). PM_{10} includes solid and liquid material suspended in the atmosphere formed as a result of incomplete combustion.

$PM_{2.5}$ - a criteria pollutant for which there are NAAQS and represents the category of particulates categorized as "fine" PM (i.e., with an aerodynamic diameter of 2.5 microns or less). These particles are considered a health risk because of their ability to penetrate deep into the human respiratory system. Aircraft are the primary source of $PM_{2.5}$ emissions at airport.

Point Source - In air quality modeling a pollutant source that is fixed to the ground and that releases pollutants through a relatively small area. Common stationary sources at airport include boilers, heaters, incinerators, and fuel storage tanks.

ppb - Parts per billion (10^9) by volume

ppm - Parts per million (10^6) by volume.

Positive Conformity Determination – A determination that demonstrates the Federal Action conforms to the SIP and the Federal Action can move forward. Otherwise, the federal agency cannot move forward with implementation of the Federal Action.

Precursor - A chemical compound that leads to the formation of a pollutant. HC and NO_x, are precursors of photochemical oxidants.

Preferred Model - A refined model that is recommended for a specific type of regulatory application.

Prevention of Significant Deterioration (PSD) Area - A geographic area that contains air which is relatively clean and not in violation of NAAQS. The emissions in these area are regulated to prevent degradation of its air quality.

Primary Pollutant - Chemical contaminants which are released directly to the atmosphere by a source.

Primary Standard - A NAAQS set to protect human health.

Receptor - A location at which ambient air quality is measured or estimated.

Record of Decision (ROD) - The decision document, prepared after the EIS, that states what the decision is, identifies all alternative considered by the lead agency in reaching its decision, and states whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why not.

Scoping - An early and open process (that invites the participation of affected Federal, state and local agencies, any affected Indian tribe, the proponent of the action and other interested persons) that determines the issues to be addressed in an environmental document and identifies relevant and/or significant issues related to a proposed action.

Screening Technique - A relatively simple analysis technique to determine if a given source is likely to pose a threat to air quality. Concentration estimates from screening techniques are conservative.

Secondary Pollutant - Atmospheric contaminants formed in the atmosphere as a result of such chemical reactions as hydrolysis, oxidation, and photochemistry.

Secondary Standard - A NAAQS set to protect human welfare.

Semi-volatile Organic Compounds (SVOCs) - an organic compound which has a boiling point higher than water and which may vaporize when exposed to temperatures above room temperature. Semi-volatile organic compounds include phenols and polynuclear aromatic hydrocarbons (PAH).

Simple Terrain - An area where terrain features are all lower in elevation than the top of the stack of the source.

Simulation Model - A mathematical description of a real physical and/or chemical process. The responses of the model to input parameter variations are analogous to those of the real processes.

Smog - A common term for ground-level ozone.

Stability - A property of the atmosphere which determines the amount of vertical mixing.

State Implementation Plan (SIP) - The strategy to be used by a state to control air pollution in order that the NAAQS will be met. EPA regulations require that each state devise such a plan or the EPA will impose its own plan for that state.

Stationary Source - A source of pollutants which is immobile. Such sources include power plants, individual heater, incinerators, fuel tanks, Aircraft Rescue and Firefighting (ARFF) training, facilities, and solvent degreasers, among others.

Sulfur Dioxide (SO_2) - This is a corrosive and poisonous gas produced mainly from the burning of sulfur containing fuel.

Thrust - A measure of the power generated by turbine engines. Thrust is measured in pounds (force) or kiloNewtons (kN). 1kN = 4,450 lb.

Total Organic Gas (TOG) - Defined by the California Air Resources Board (CARB) as compounds of carbon, excluding CO, CO_2, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. TOG includes all organic gas compounds emitted to the atmosphere, including the low reactivity compounds (e.g., methane, ethane, various chlorinated fluorocarbons, acetone, perchloroethylene, volatile methyl siloxanes, and oxygenated OG).

Transportation Implementation Plan - A plan that analyzes the current transportation system, near-term transportation projects and provides an option of probable costs to implement solutions.

Turbulence - Unsteady and irregular motions of air in the atmosphere.

Vehicle Miles Traveled (VMT) - The sum of distances traveled by all motor vehicles in a specified region. VMT is equal to the total number of vehicle trips multiplied by the trip distance (measured in miles). This sum is used in computing an emissions inventory for motor vehicles.

Volatile Organic Compounds (VOCs) - VOCs are created when fuels or organic waste materials are burned. Most HCs are presumed to be VOCs in the regulatory context, unless otherwise specified by the EPA.

Acronyms and Abbreviations

AAS	Airport Safety and Standards
ACCRI	Aviation Climate Change Research Initiative
ACRP	Airport Cooperative Research Panel
AEDT	Aviation Environmental Design Tool
AEE	FAA Office of Environment and Energy
AERCs	Airport Emission Reduction Credits
AFS	Airport Flight Standards Service
AGC	Office of the Chief Counsel
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AIP	Airport Improvement Program
ALP	Airport Layout Plan
APE	Area of Potential Effects
APL	Office of Policy, International Affairs, and Environment
APP	Airport Planning and Programming
APU	Auxiliary Power Unit
ARP	Office of the Associate Administrator for Airports
ASIF	AEDT Standard Input File
ATO	Air Traffic Organization
AVS	Aviation Safety
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CARB	California Air Resources Board
CATEX	Categorical Exclusion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	Methane
CNG	Compressed Natural Gas
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent

DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
EA	Environmental Assessment
EDMS	Emissions and Dispersion Modeling System
EERE	DOE Office of Energy Efficiency & Renewable Energy
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FIP	Federal Implementation Plan
FONSI/ROD	Finding of No Significant Impact/Record of Decision
FTA	Federal Transit Administration
GA	General Aviation
GAO	General Accounting Office
GCRP	Global Change Research Program
GHGs	Greenhouse Gases
GPU	Ground Power Units
GSE	Ground Support Equipment
GWP	Global Warming Potential
H_2O	Water Vapor
HAPs	Hazardous Air Pollutants
HC	Hydrocarbons
HFCs	Hydrofluorocarbon
ICAO	International Civil Aviation Organization
INM	Integrated Noise Model
IPCC	Intergovernmental Panel on Climate Change
IRIS	Integrated Risk Information System
ISR	Indirect Source Review
LOB/SOs	Lines of Business and Staff Offices
LOS	Level-of-Service
LPG	Liquefied petroleum gas

LTO	Landing-takeoff cycle
MOU	Memorandum of Understanding
MOVES	Motor Vehicle Emissions Simulator
MPO	Metropolitan Planning Organization
MT CO_2	Metric tons of CO_2
MT CO_{2e}	Metric tons of CO_2 equivalent
MWC	Municipal Waste Combustors
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NIRS	Noise Integrated Routing System
NO	Nitric oxide
NO_2	Nitrogen Dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	Nitrogen Oxide
O_3	Ozone
OFEE	Office of the Federal Environmental Executive
OTAQ	EPA Office of Transportation and Air Quality
OTR	Ozone Transport Region
PARTNER	Partnership for Air Transportation Noise & Emissions Reduction
Pb	Lead
PCA	Preconditioned air
PFCs	Perfluorocarbons
PM	Particulate Matter
PM_{10}	Particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 2.5 microns or less
RFP	Reasonable Further Progress Plans
ROD	Record of Decision
ROP	Rate of Progress

SF_6	Sulfur hexafluoride
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
TDS	Total Dissolved Solids
TIM	Times-in-mode
TIP	Tribal Implementation Plan
TOG	Total Organic Gas
TRB	Transportation Research Board
$\mu g/m^3$	Micrograms per cubic meter
VALE	Voluntary Airport Low Emissions
VMT	Vehicle Miles Travelled
VOCs	Volatile Organic Compound