Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA

Purpose

This guidance document provides information on the use of AEDT to conduct environmental modeling of aircraft noise, fuel burn, and emissions for FAA actions subject to the National Environmental Policy Act (NEPA).

Applicability

Aircraft noise, fuel burn, and emissions are interdependent and occur simultaneously throughout all phases of flight. AEDT is a comprehensive software tool that provides information to FAA and its stakeholders on each of these specific environmental impacts. AEDT facilitates environmental review activities required under NEPA by consolidating the modeling of these environmental impacts in a single tool.

As published in the *Federal Register* (80 FR 27853), AEDT 2b replaced previous versions of AEDT, the Integrated Noise Model (INM) and the Emissions and Dispersion Modeling System (EDMS) as the required tool for noise, fuel burn, and emissions modeling of FAA actions. Guidance on AEDT version determination for project use is available on the AEDT website. (https://aedt.faa.gov/Documents/AEDT_Version_Guidance_Memo.pdf).

While the AEDT User Guide provides information on default data and how to use AEDT, this document provides information on how to use the tool to satisfy the requirements of NEPA in accordance with FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures* and related FAA guidance documents.

This document is organized to reflect the ways in which AEDT is used to conduct different types of studies (or use cases), depending on the metric(s) of interest. There are five sections:

- Emissions Inventory Only
- Emissions Inventory and Emissions Dispersion
- Emissions Inventory and Noise
- Emissions Inventory, Emissions Dispersion, and Noise
- Non-Default Methods and Data

1 Emissions Inventory Only

An emissions inventory provides the total amount or mass of pollutants generated by various sources during a specific period of time. More advanced inventories may also spatially allocate emissions for specific source purposes. This section describes guidance to develop aviation emissions inventories for FAA actions.

Aviation sources and characteristics are tabulated in Table 3-2 of the FAA *Aviation Emissions and Air Quality Handbook Version 3*, hereafter referred to as the *Air Quality Handbook.*

AEDT can model the following types of emission sources:[1]

- Point sources: stacks from boilers, turbines, generators, and cooling towers;
- Area sources: activity at aircraft gate aprons (aircraft at startup, Ground Support Equipment [GSE] operations, and Auxiliary Power Unit [APU] activity), aircraft taxiing, queuing, accelerating on the runway, and in takeoff, climb-out, and approach modes; and
- Volume sources: any source with both area and height elements, e.g., fuel storage facility.

Emissions from on-road mobile ground sources (such as ground access vehicles) cannot be modeled with AEDT but may be modeled independently using the EPA MOVES model.

This section provides guidance on the following elements of an emissions inventory analysis:

- Representation of results;
- Aircraft operations and schedules;
- Use of weather information; and
- Flight paths.

The outputs of the emissions analysis are tables showing the total amount of each target compound emitted by each source under specified conditions and time periods.

1.1 Representation of results

Emissions inventory results are generally tabulated in tons of pollutant or compound for the time period of interest—typically in units of tons per year. Results may be aggregated for the entire study area, or segregated by emissions source or by proposed action and alternative(s).[2]

1.1.1 Criteria pollutants

When an emissions inventory of criteria pollutants[3] is conducted,[4] it should report the total sum of criteria pollutants emitted from all sources within the study area (i.e., the area potentially affected by criteria pollutant emissions from the proposed action and alternative(s)) extending from the ground surface up to the local mixing height (or 3,000 ft. above ground level [AGL] where the mixing height is not identified in the applicable State Implementation Plan [SIP] or Tribal Implementation Plan [TIP]). The mixing height is the top of the vertical region of the

[1] *Air Quality Handbook*, Appendix D, section D.2.2.
[2] *Air Quality Handbook*, section 4.1.2.
[3] *Air Quality Handbook*, section 3.2.1.
[4] Section 4.1.2 of the *Air Quality Handbook* provides guidance on selecting an appropriate air quality assessment methodology. Aircraft emissions above the mixing height (or 3,000 ft. AGL when the mixing height is not identified in the applicable SIP or TIP) are exempt from study as they have been determined to be *de minimis*. 40 CFR §93.153(c)(2)(xxii); see also 75 Fed. Reg. 17257-17258 (April 5, 2010).

atmosphere in which pollutant mixing occurs and affects ground level concentrations. Above this height, pollutants that are released generally do not mix with ground level emissions and do not have an effect on ground level concentrations in the local area.

See Table 6-2 of the *Air Quality Handbook* for an example of an operational emissions inventory.

Construction emissions, while they are generally temporary in nature, are also commonly reported in tons per year. See section 6.1.4.2 of the *Air Quality Handbook* for more information. Note that AEDT does not compute construction emissions.

For purposes of compliance with NEPA and the Clean Air Act, emissions inventory reporting is primarily intended to: (1) disclose the differences in pollutant emissions between the project alternatives (i.e., action vs. no-action); and (2) demonstrate that, in nonattainment and/or maintenance areas, the proposed action is below the appropriate General Conformity *de minimis* thresholds.[5] If the proposed action is above the appropriate *de minimis* thresholds, consult the *Air Quality Handbook* for advanced compliance steps.[6]

1.1.2 Hazardous air pollutants

The type(s) and number of hazardous air pollutants (HAPs) reported in an airport-related emissions inventory will depend on the types of sources evaluated, the types of fuel used, and other emissions characteristics. See section 6.2 and Appendix B of the *Air Quality Handbook* for more information.

1.1.3 Fuel burn and greenhouse gas emissions

When greenhouse gas (GHG) emissions are inventoried,[7] they are computed based on fuel burn, energy usage, and/or activity levels of the various sources. The only GHG emissions AEDT calculates are CO_2 emissions from aircraft engines. For computing GHG emissions not modeled by AEDT, see Appendix C of the *Air Quality Handbook*.

If fuel burn and GHG emissions are computed as part of a NEPA analysis,[8] they should be reported for the full extent of aircraft movements as part of the project changes with no altitude restriction (not constrained by the mixing height). Fuel burn and GHG evaluation should include the same emission sources that are included in the air quality analysis.

1.2 Aircraft operations and schedules

Aircraft emissions for an 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. AEDT calculates a performance-

[5] *Air Quality Handbook*, Tables 8-1 and 8-2.

[6] *Air Quality Handbook*, Chapter 8. If dispersion modeling is conducted, see Section 2.1.2 of this guidance regarding use of the results of such modeling for NEPA and Clean Air Act compliance.

[7] For guidance regarding when GHG emissions should be quantified, see Chapter 3 of the 1050.1F Desk Reference..

[8] For NEPA reviews, GHG emissions should be quantified when fuel burn is computed and reported in the NEPA document. See Chapter 3 of the 1050.1F Desk Reference..

based time in mode for the takeoff, approach, and climb out components of the Landing and Take-Off (LTO) cycle, which is based upon aircraft flight profiles, characteristics of individual aircraft, and meteorological conditions. For an emissions inventory, AEDT uses static times in mode for ground-based aircraft movements.[9] AEDT allows the input of times in mode explicitly per event, configuration of the ground delay and sequencing function, or the application of airport static times in mode.

Aircraft operations inputs to compute an emissions inventory, fuel burn, or GHG emissions may include:

- Number of operations (i.e., landings and takeoffs) by each aircraft in the year(s) of study;
- Fleet mix, specifying each airframe and engine;
- Aircraft flight paths;
- Aircraft ground movements;
- Taxi times-in-mode (per event, delay/sequencing, or airport static); and
- For more detailed emissions analyses, include operational profile(s) (i.e., number of flights in the month, day, and hour or quarter-hour relative to the peak).

Non-aircraft operations inputs may include:

- Auxiliary power units;
- Ground support equipment, e.g., aircraft tugs, air start units, loaders, tractors, fuel or hydrant trucks;
- Stationary sources, e.g., boilers, heaters, generators, snowmelters, incinerators, fire training facilities, fuel storage tanks, painting operations, de-icing and anti-icing operations, salt/sand storage.

Appendix F of the *Air Quality Handbook* provides details of the data needed for each input of airport operations.

1.3 Use of weather information

AEDT default weather data include average annual weather (i.e., based on 30-year normals and 10-year averages) for each airport,[10] as well as International Standard Atmosphere (ISA) conditions.[11] In addition, AEDT accepts more detailed weather data (in space and/or time). Default or more detailed weather for each airport may be selected, depending on the type of analysis.

While there is no singular, standard weather data source requirement to compute an emissions inventory, AEDT default weather data are typically acceptable. Coordinate with the appropriate FAA office if there is uncertainty regarding the use of weather and its potential influence in a specific study.

[9] *Air Quality Handbook*, section 6.1.3.
[10] Data acquired from NOAA National Climatic Data Center website
[11] The International Standard Atmosphere is an atmospheric model of how the pressure, temperature, density, and viscosity of the Earth's atmosphere change over a wide range of altitudes.

The same weather source used to compute the emissions inventory of criteria pollutants should be used to compute fuel burn and CO_2 emissions.

1.4 Flight paths

Aircraft operations are modeled on ground tracks. AEDT allows for the development of studies with ground track geometry that include both straight and curved flight paths. For analyses that include an emissions inventory, modeled ground tracks should approximate actual flight paths in the study area. Coordinate with the appropriate FAA office if there is uncertainty regarding the use of ground tracks.

2 Emissions Inventory and Emissions Dispersion

An emissions inventory provides the total amount or mass of pollutants generated by various sources during a specific period of time. More advanced inventories may also spatially allocate emissions for specific source purposes.

Emissions dispersion modeling is used to further refine the results of an emissions inventory. Emissions dispersion modeling is the process by which the dispersal of atmospheric pollutants is simulated and assessed under the effects of meteorological, terrain, and other influencing factors. In other words, emissions dispersion modeling carefully calculates the pollutant concentrations in units of mass per volume from the source to a receptor, taking into account meteorological influences.

The dispersion model used by AEDT is AERMOD, which is a modern Gaussian plume model that computes dispersion of air pollutant emissions spread in the horizontal and vertical directions, determined as a function of atmospheric stability and distance from the emission source.[12]

AEDT can model the following types of emission sources:[13]

- Point sources: stacks from boilers, turbines, generators, and cooling towers;
- Area sources: activity at aircraft gate aprons (aircraft at startup, GSE operations, and APU activity), aircraft taxiing, queuing, accelerating on the runway, and in takeoff, climb-out, and approach modes; and
- Volume sources: any source with both area and height elements, e.g., fuel storage facility.

Emissions from on-road mobile ground sources (such as ground access vehicles) cannot be modeled with AEDT but may be modeled independently using the EPA MOVES model. A detailed explanation of emissions dispersion requirements is provided in the *Air Quality Handbook* in section 7 and Appendix D.

This section provides guidance on the following elements of an analysis that includes an emissions inventory and emissions dispersion:

- Representation of results;
- Aircraft operations and schedules;
- Use of weather information;
- Flight paths; and
- Use of terrain information.

Section 1 provides details on conducting an emissions inventory. This section provides additional information applicable to a study that also includes emissions dispersion.

[12] EPA Preferred/Recommended Models
[13] *Air Quality Handbook*, Appendix D, section D.2.2.

2.1 Representation of results

Emissions inventory results are generally tabulated in tons of pollutant or compound for the time period of interest—typically in units of tons per year. Results may be aggregated for the entire study area, or segregated by emissions source or by proposed action and alternative(s).[14]

Emissions dispersion results may be presented in both tabular and graphical displays. They include short-term (1-, 3-, 8-, 24-hour) and long-term (annual) average concentrations reported in micrograms per cubic meter ($\mu g/m^3$) by AEDT at each receptor location, depending on the type of analysis and the National Ambient Air Quality Standards (NAAQS) for each criteria pollutant. AEDT does not model lead, and the rolling 3-month average concentrations are not included in tabular or graphical displays. Lead may be modeled independently of AEDT.[15]

The following sections provide information on emissions dispersion receptors and criteria pollutants. Sections 1.1.2, 1.1.3, and 1.1.4 provide information on computing emissions inventories for hazardous air pollutants (HAPs), greenhouse gases (GHGs), and fuel burn, respectively. Such inventories do not include dispersion modeling. The science of HAPs reactions in the atmosphere and downstream plume evolution is still evolving and the level of understanding is currently limited.[16] Therefore, due to the state of the science, dispersion modeling is not conducted for HAPs. The global nature of GHGs makes it inappropriate for dispersion modeling.

2.1.1 Emissions dispersion receptors

Encompassed within the study area (i.e., the area potentially affected by criteria pollutant emissions from the proposed action and alternative(s)) are all sources of emissions that directly affect the local area concentrations. In AEDT, emissions dispersion receptors are locations where pollutant concentrations are evaluated. Pollutant concentrations should be predicted at a sufficient number of receptor locations to identify the maximum concentrations. If an overall view of pollutant concentration is desired, then a grid of receptors should be defined. The dispersion analysis should include enough receptors to sufficiently describe pollutant concentrations in the study area. Appendix D of the *Air Quality Handbook* provides additional information on emissions dispersion receptors.

2.1.2 Criteria pollutants

When an emissions inventory of criteria pollutants[17] is conducted,[18] it should be reported within the study area (i.e., the area potentially affected by criteria pollutant emissions from the proposed action and alternative(s)) extending from the ground surface up to the local mixing height (or 3,000 ft. AGL where the mixing height is not identified in the applicable SIP or TIP). The

[14] *Air Quality Handbook*, section 4.1.2.
[15] EPA, Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory, December 2010, EPA-420-B-10-044.
[16] *Air Quality Handbook*, section 6.2.3.
[17] *Air Quality Handbook*, section 3.2.1.
[18] Section 4.1.2 of the *Air Quality Handbook* provides guidance on selecting an appropriate air quality assessment methodology. Aircraft emissions above the mixing height (or 3,000 ft. AGL when the mixing height is not identified in the applicable SIP or TIP) are exempt from study as they have been determined to be *de minimis*. 40 CFR §93.153(c)(2)(xxii); see also 75 Fed. Reg. 17257-17258 (April 5, 2010).

mixing height is the top of the vertical region of the atmosphere in which pollutant mixing occurs and affects ground level concentrations. Above this height, pollutants that are released generally do not mix with ground level emissions and do not have an effect on ground level concentrations in the local area.

See Table 6-2 of the *Air Quality Handbook* for an example of an operational emissions inventory.

When emissions dispersion modeling is conducted at airports, it generally includes CO, NO_2, PM_{10} and $PM_{2.5}$; dispersion modeling of SO_2 and Pb are less frequently conducted due to their expected low ambient levels[19] and generally low emissions in terms of aviation sources. AEDT dispersion modeling predicts total NO_2 concentrations using the Tier 1 method, which assumes all NO_x as NO_2 for comparison to the NAAQS.[20] Ozone is a regional pollutant resulting primarily from the combined effects of VOCs and NO_x in the presence of sunlight and thus not conducive to dispersion modeling on a local scale.

Dispersion modeling results consist of the time-weighted maximum or average concentrations of pollutants at each receptor analyzed over a specified time period, depending on the type of analysis and NAAQS for each criteria pollutant. For purposes of compliance with NEPA and the Clean Air Act, the reporting is primarily intended to: (1) disclose the differences in pollutant concentrations between the project alternatives (i.e., action vs. no-action); (2) show whether any of the action alternative(s) would result in exceedance of the NAAQS in attainment areas; and (3) demonstrate that, in nonattainment and/or maintenance areas, the proposed action will not cause or contribute to a violation of any NAAQS nor delay the attainment of any NAAQS.[19]

Appendix D of the *Air Quality Handbook* provides additional information on dispersion modeling.

2.2 Aircraft operations and schedules

Aircraft emissions for an emissions inventory and the emissions dispersion computation that follow 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. AEDT calculates a performance-based time in mode for the takeoff, approach and climb out components of the LTO cycle, which is based upon aircraft flight profiles, characteristics of individual aircraft, and meteorological conditions. For an emissions dispersion analysis, ensure that emissions from aircraft ground movements are properly located in time and space. This can be achieved by using AEDT's ground delay and sequencing function, which models aircraft ground locations in time and space based on airport layout and capacity parameters.

Aircraft operations inputs to compute an emissions inventory, emissions dispersion, fuel burn, or GHG emissions may include:

- Number of operations (i.e., landings and takeoffs) by each aircraft in the year(s) of study;

[19] *Air Quality Handbook*, section 7.1.4.
[20] [Appendix W to 40 CFR part 51 – Guideline on Air Quality Models]

- Fleet mix, specifying each airframe and engine;
- Aircraft flight paths;
- Aircraft ground movements, represented in time and space;
- Airport layout and capacity parameters; and
- Operational profile(s) (i.e., number of flights in the month, day, and hour or quarter-hour relative to the peak).

As an alternative to number of operations and operational profile(s), a detailed schedule of annual operations (i.e., time-stamped flights for the year of study, which includes the fleet and operations for the entire year) may be provided.

Non-aircraft operations inputs may include:

- Auxiliary power units;
- Ground support equipment, e.g., aircraft tugs, air start units, loaders, tractors, fuel or hydrant trucks;
- Stationary sources, e.g., boilers, heaters, generators, snowmelters, incinerators, fire training facilities, fuel storage tanks, painting operations, de-icing and anti-icing operations, salt/sand storage.

The *Air Quality Handbook* Appendix F provides details of the data needed for each input of airport operations.

2.3 Use of weather information

When emissions dispersion analysis is conducted, surface and upper air weather data must be used to compute both the emissions inventory and emissions dispersion analyses. There is no singular, standard weather data source for emissions inventory or dispersion computation. The weather data needed to compute emissions dispersion must meet EPA guidance[21] and the AERMOD format. Use of AERMET to form compliant weather input for AERMOD allows use of data sets from the National Weather Service (NWS), on-site data, or detailed one-minute data. For example, NCDC ASOS/Upper Air format meets the requirements to compute emissions dispersion. Conduct interagency coordination to determine the appropriate weather data to use for the analysis.

The same weather source used to compute the emissions inventory of criteria pollutants should be used to compute fuel burn and CO_2 emissions.

2.4 Flight paths

Aircraft operations are modeled on ground tracks. AEDT allows for the development of studies with ground track geometry that include both straight and curved flight paths. For analyses that include an emissions inventory and emissions dispersion, modeled ground tracks should approximate actual flight paths in the study area. Coordinate with the appropriate FAA office if there is uncertainty regarding the use of ground tracks.

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[21] US EPA, "Meteorological Monitoring Guidance for Regulatory Modeling Applications," EPA-454/R-99-005, February 2000.

2.5 Use of terrain information

AEDT allows users to import terrain files and use terrain data in emissions dispersion. When terrain is not applied in AEDT, the model computes receptor-to-source distances in the emissions dispersion calculations based on flat ground.

In regions where topography is relatively flat, use of terrain is not required for environmental studies. If there is uncertainty in the use of terrain and its potential influence on pollutant concentrations in a specific study, coordinate with the appropriate reviewing authority.

3 Emissions Inventory and Noise

An emissions inventory provides the total amount or mass of pollutants generated by various sources during a specific period of time. More advanced inventories may also spatially allocate emissions for specific source purposes.

AEDT can model the following types of emission sources:[22]

- Point sources: stacks from boilers, turbines, generators, and cooling towers;
- Area sources: activity at aircraft gate aprons (aircraft at startup, GSE operations, and APU activity), aircraft taxiing, queuing, accelerating on the runway, and in takeoff, climb-out, and approach modes; and
- Volume sources: any source with both area and height elements, e.g., fuel storage facility.

Emissions from on-road mobile ground sources (such as ground access vehicles) cannot be modeled with AEDT but may be modeled independently using the EPA MOVES model.

Noise exposure modeling identifies locations exposed to specified levels of aircraft-generated noise, both in and outside the project location. The standard noise metric is the yearly day-night average sound level (DNL or L_{dn}). Community Noise Equivalent Level (CNEL) may be used in lieu of DNL for noise analysis of FAA actions in California.

While aircraft emissions inventories are primarily a function of aircraft fleet mix and operational schedules, the noise generated by aircraft is also affected by additional factors, including weather, the local terrain, the locations and usage of specific flight paths, and the weight of departing aircraft (as heavier aircraft have a slower rate of climb and wider noise dispersion).

This section provides guidance on the following elements of an analysis that includes emissions inventory and noise:

- Representation of results;
- Aircraft operations and schedules;
- Use of weather information;
- Flight paths;
- Use of terrain information; and
- Use of lateral attenuation for propeller aircraft and helicopters.

Section 1 provides details on conducting an emissions inventory. This section provides additional information applicable to a study that includes both noise and an emissions inventory.

[22] *Air Quality Handbook*, Appendix D, section D.2.2

3.1 Representation of results

When an emissions inventory of criteria pollutants[23] is conducted,[24] it should be reported within the study area (i.e., the area potentially affected by criteria pollutant emissions from the proposed action and alternative(s)) extending from the ground surface up to the local mixing height (or 3,000 ft. AGL where the mixing height is not identified in the applicable SIP or TIP). The mixing height is the top of the vertical region of the atmosphere in which pollutant mixing occurs and affects ground level concentrations. Above this height, pollutants that are released generally do not mix with ground level emissions and do not have an effect on ground level concentrations in the local area.

For noise analysis of airport actions, the study area must be large enough to include the area within the DNL 65 dB contour, and may be larger.[25] For noise analysis of air traffic airspace and procedure actions, the study area may extend vertically from the ground to 10,000 ft. AGL, or up to 18,000 ft. AGL if the proposed action or alternative(s) are over a national park or wildlife refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute.[26]

If fuel burn and GHG emissions are computed as part of a NEPA analysis,[27] they should be reported for the full extent of aircraft movements as part of the project changes with no altitude restriction (not constrained by the mixing height). Fuel burn and GHG evaluation should include the same emission sources that are included in the air quality analysis.

Figure 3-1 is a sample of an impact set graph, which shows detailed comparative data for receptors exposed to specific ranges of noise. The *Change Summary* table in Figure 3-1 provides a summary of the number of receptors or the population count that has either entered or exited the 65 dB or greater criteria for a comparison of two scenarios.[28] Table 3-1 is a sample format for reporting changes in noise exposure levels for specific noise-sensitive locations for air traffic airspace and procedure actions. It should be noted that there is more than one way to present this information, and the tables below are provided as examples only and should not be considered as a required format.

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[23] *Air Quality Handbook*, section 3.2.1.

[24] Section 4.1.2 of the *Air Quality Handbook* provides guidance on selecting an appropriate air quality assessment methodology. Aircraft emissions above the mixing height (or 3,000 ft. AGL when the mixing height is not identified in the applicable SIP or TIP) are exempt from study as they have been determined to be *de minimis*. 40 CFR §93.153(c)(2)(xxii); see also 75 Fed. Reg. 17257-17258 (April 5, 2010).

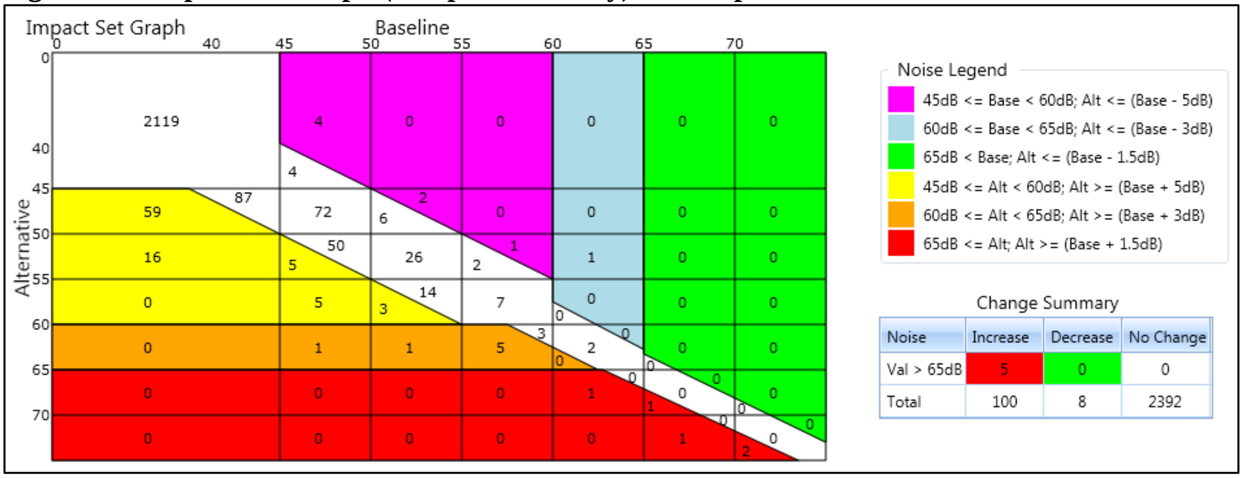
[25] If DNL 1.5 dB increases are documented within the DNL 65 dB for an action in the immediate vicinity of an airport, the NEPA document must also identify noise sensitive areas where noise is projected to increase by DNL 3 dB or more within the DNL 60-65 dB contours. Disclosure of noise impacts outside the DNL 65 dB contour may also be warranted in connection with the consideration of noise impacts in areas where the land use compatibility guidelines in 14 CFR part 150 may not be relevant. See FAA Order 1050.1F, Appendix B, paragraph B-1.4.

[26] See FAA Order 1050.1F, Appendix B, paragraph B-1.3; FAA Order 7400.2K, section 32-2-1.b.2.

[27] For NEPA reviews, GHG emissions should be quantified when fuel burn is computed and reported in the NEPA document. See Chapter 3 of the 1050.1F Desk Reference..

[28] AEDT 2b User Guide, section 5.6.7, View Impact Report.

Figure 3-1: Impact Set Graph (Sample Data Only) – Example



Source: AEDT User Guide

Table 3-1: Increased Noise Exposure at Sensitive Locations – 2014 (Sample Data Only) -- Example

Year	Location	No Action Noise Exposure (DNL)	Proposed Action Noise Exposure (DNL)	Change Noise Exposure (DNL)
2014	XX State Wildlife Refuge *Street Address, Town, ST*	45.4	48.5	3.1
2014	St XX Church *Street Address, Town, ST*	45.1	47.6	2.5
2014	XXX Hospital *Street Address, Town, ST*	46.9	52.1	5.2

3.2 Aircraft operations and schedules

Aircraft operations are the flight schedule information input to AEDT to compute aircraft performance and affect environmental results. Inputs include fleet mix (i.e., airframe, engine), number of operations, and operational profile (i.e. the distribution of operations over time).

Aircraft operations inputs to compute noise, an emissions inventory, fuel burn, or GHG emissions may include:

- Number of operations by aircraft type in the year(s) of study;
- Fleet based on annual operations;
- Aircraft flight paths;
- Aircraft ground movements for emissions; and
- Number of day and night operations by aircraft type for the Day-Night Average Sound Level (DNL) noise metric. For the Community Noise Equivalent Level (CNEL) noise metric only, also include the number of evening operations by aircraft type.

Alternatively, a detailed schedule of annual operations (i.e., time-stamped flights for the year of study, which includes the fleet and operations for the entire year) may be provided. AEDT will annualize the data to an average annual day to compute the noise impact.

If delay and sequencing is applied to the aircraft operations in a noise metric result, the scheduled and actual time for each operation should be compared to determine whether there is a change. Coordinate with the Office of Environment and Energy (AEE) if there are differences between scheduled and actual times for noise operations that occur across the day and night time periods for the DNL metric or day, evening, and night time periods for the CNEL metric.

For emissions only, non-aircraft operations inputs may include:

- Auxiliary power units;
- Ground support equipment, e.g., aircraft tugs, air start units, loaders, tractors, fuel or hydrant trucks;
- Stationary sources, e.g., boilers, heaters, generators, snowmelters, incinerators, fire training facilities, fuel storage tanks, painting operations, de-icing and anti-icing operations, salt/sand storage.

3.3 Use of weather information

This section describes the use of weather data and atmospheric absorption.

3.3.1 Weather data

AEDT default weather data include average annual weather (i.e., based on 30-year normals and 10-year averages) for each airport,[29] as well as International Standard Atmosphere (ISA) conditions.[30] In addition, AEDT accepts more detailed weather data (in space and/or time). Default or more detailed weather for each airport may be selected, depending on the type of analysis.

For airport actions, AEDT default airport-specific average weather conditions should be used to compute noise for the airport to be studied. Use of non-default weather data requires written approval from AEE (see section 5, Non-Default Methods and Data).

For air traffic airspace and procedure actions, AEDT default airport-specific average weather conditions for the airport(s) to be studied should be used to compute noise. Use of non-default weather data requires written approval from AEE (see section 5).

While there is no singular, standard weather data source requirement to compute an emissions inventory, the same AEDT default airport-specific average weather data are typically acceptable, when an emissions inventory is required.[31]

The same weather source used to compute the emissions inventory of criteria pollutants should be used to compute fuel burn and CO_2 emissions.

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[29] Data acquired from NOAA National Climatic Data Center website

[30] The International Standard Atmosphere is an atmospheric model of how the pressure, temperature, density, and viscosity of the Earth's atmosphere change over a wide range of altitudes.

[31] An aircraft emissions inventory is needed for studies where there are changes below the altitude of the airport's mixing height (or 3,000 ft. AGL where the mixing height is not identified in the applicable SIP or TIP). Aircraft emissions above the mixing height (or 3,000 ft. AGL when the mixing height is not identified) are exempt from study as they have been determined to be *de minimis*. 40 CFR §93.153(c)(2)(xxii); see also 75 Fed. Reg. 17257-17258 (April 5, 2010).

Coordinate with the appropriate FAA office if there is uncertainty regarding the use of weather and its potential influence in a specific study.

3.3.2 Atmospheric absorption [noise only]

Atmospheric absorption is the calculation of the absorption of sound by the atmosphere due to weather conditions (temperature, relative humidity, atmospheric pressure, etc.). In AEDT, the airport average weather conditions in the study are used to calculate atmospheric absorption adjustments to standard Noise-Power-Distance (NPD) curves.

For noise analyses of FAA actions, the atmospheric absorption type "*SAE-ARP-5534*" must be selected in AEDT Processing Options. This function uses the method described in Society of Automotive Engineers' (SAE) Aerospace Recommended Practice (ARP) 5534, taking into account changes in atmospheric absorption due to airport specific temperature, relative humidity, and atmospheric pressure.

3.4 Flight paths

3.4.1 Ground track geometry

Aircraft operations are modeled on ground tracks. AEDT allows for the development of studies that include both straight and curved ground track geometry. For analyses that include emissions inventory and noise, modeled ground tracks should approximate actual flight paths in the study area. Coordinate with the appropriate FAA office if there is uncertainty regarding the use of ground tracks.

3.4.2 Track dispersion

Ground tracks are typically consolidated, or "bundled," to represent average movements around an airport in an analysis. The potential effects that the modeling technique of bundling ground tracks may have on study results should be considered, as there are different implications on noise, fuel burn, and emissions results. Specifically, care should be taken to ensure that bundled ground tracks and the aircraft types that are modeled on those tracks represent actual operations in the study area in terms of flight path dispersion around the airport and the aircraft types that fly those flight paths.

3.5 Use of terrain information

AEDT allows users to import terrain files and use terrain data in noise computations. When terrain is not applied in AEDT, the model computes receptor-to-source distances in the noise calculations based on flat ground.

In regions where topography is relatively flat, use of terrain is not required for environmental studies. If there is uncertainty in the use of terrain and its potential influence on noise exposure in a specific study, coordinate with the appropriate reviewing authority.

For noise analyses, terrain files can be applied with or without line-of-sight blockage. Although line-of-sight blockage is not required for environmental studies, it should be considered for analyses that have substantial terrain features located between the aircraft noise sources and the noise receptors. Coordinate with the appropriate FAA office if there is uncertainty regarding the use of line-of-sight blockage and its potential influence on noise exposure in a specific study.

3.6 Use of lateral attenuation for propeller aircraft and helicopters [noise only]

For noise analyses, lateral attenuation describes the difference in sound level between the sound directly under an aircraft's flight path and at a location to the side of the aircraft. In AEDT, the lateral attenuation adjustment is based on the methods described in the SAE Aerospace Information Report (AIR) 5662 "Method for Predicting Lateral Attenuation of Airplane Noise." It takes into account the following effects on aircraft sound due to over-ground propagation: (1) ground reflection effects; (2) atmospheric refraction effects; and (3) airplane shielding effects, as well as other ground and engine/aircraft installation effects.

AEDT assumes that sound propagation occurs over acoustically soft ground (i.e. grass/trees), which is appropriate for the majority of analyses. AEDT also has a setting to turn off lateral attenuation for flights from helicopters and propeller-driven airplanes, effectively assuming propagation over acoustically hard ground (i.e., pavement/water), while soft ground effects would still apply to other aircraft types.[32]

For noise analyses of FAA actions, lateral attenuation must be modeled for all aircraft types, including helicopters and propeller-driven airplanes, assuming acoustically soft ground (ensure that the box "*Use hard ground attenuation for helicopters and propeller aircraft*" is unchecked in AEDT Processing Options). Written approval from AEE-100 is required if the default lateral attenuation setting is not used. See section 5 on Non Default Methods and Data for information on request and approval processes.

[32] Sometimes lateral attenuation is not used when source-to-receiver propagation occurs primarily over an acoustically hard surface (e.g., water), the hard surface dominates the study environment, and there are low-altitude helicopter and propeller-driven aircraft operations.

4 Emissions Inventory, Emissions Dispersion, and Noise

An emissions inventory provides the total amount or mass of pollutants generated by various sources during a specific period of time. More advanced inventories may also spatially allocate emissions for specific source purposes.

Emissions dispersion modeling is used to further refine the results of an emissions inventory. Emissions dispersion modeling is the process by which the dispersal of atmospheric pollutants is simulated and assessed under the effects of meteorological, terrain, and other influencing factors.

AEDT can model the following types of emission sources:[33]

- Point sources: stacks from boilers, turbines, generators, and cooling towers;
- Area sources: activity at aircraft gate aprons (aircraft at startup, GSE operations, and APU activity), aircraft taxiing, queuing, accelerating on the runway, and in takeoff, climb-out, and approach modes; and
- Volume sources: any source with both area and height elements, e.g., fuel storage facility.

Emissions from on-road mobile ground sources (such as ground access vehicles) cannot be modeled with AEDT but may be modeled independently using the EPA MOVES model. A detailed explanation of emissions dispersion requirements is provided in the *Air Quality Handbook* in section 7 and Appendix D.

Noise exposure modeling identifies locations exposed to specified levels of aircraft-generated noise, both in and outside the project location. The standard noise metric is the yearly day-night average sound level (DNL). Community Noise Equivalent Level (CNEL) may be used in lieu of DNL for noise analysis of FAA actions in California.

While aircraft emissions are primarily a function of aircraft fleet mix and operational schedules, the noise generated by aircraft and emissions dispersion are affected by additional factors, including weather, the local terrain, the locations and usage of specific flight paths, and the weight of departing aircraft (as heavier aircraft have a slower rate of climb and wider noise dispersion).

This section provides guidance on the following elements of an analysis that includes emissions inventory, emissions dispersion, and noise:

- Representation of results;
- Aircraft operations and schedules;
- Use of weather information;
- Flight paths;
- Use of terrain information; and
- Use of lateral attenuation for propeller aircraft and helicopters.

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[33] *Air Quality Handbook*, Appendix D, section D.2.2

Section 1 provides details on conducting an emissions inventory. Section 2 provides details on conducting a study that includes an emissions inventory and emissions dispersion. Section 3 provides details on conducting an emissions inventory and a noise study. This section provides information applicable to a study that includes noise, an emissions inventory, and emissions dispersion.

4.1 Representation of results

When an emissions inventory and emissions dispersion of criteria pollutants[34] is conducted,[35] it should be reported within the study area (i.e., the area potentially affected by criteria pollutant emissions from the proposed action and alternative(s)) extending from the ground surface up to the local mixing height (or 3,000 ft. AGL where the mixing height is not identified in the applicable SIP or TIP). The mixing height is the top of the vertical region of the atmosphere in which pollutant mixing occurs and affects ground level concentrations. Above this height, pollutants that are released generally do not mix with ground level emissions and do not have an effect on ground level concentrations in the local area.

For noise analysis of airport actions, the study area must be large enough to include the area within the DNL 65 dB contour, and may be larger.[36] For noise analysis of air traffic airspace and procedure actions, the study area may extend vertically from the ground to 10,000 ft. AGL, or up to 18,000 ft. AGL if the proposed action or alternative(s) are over a national park or wildlife refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute.[37]

If fuel burn and GHG emissions are computed as part of a NEPA analysis,[38] they should be reported for the full extent of aircraft movements as part of the project changes with no altitude restriction (not constrained by the mixing height). Fuel burn and GHG evaluation should include the same emission sources that are included in the air quality analysis.

Section 2.1 provides information on receptor locations and reporting results for emissions dispersion. Section 3.1 provides this information for noise.

[34] *Air Quality Handbook*, section 3.2.1.

[35] Section 4.1.2 of the *Air Quality Handbook* provides guidance on selecting an appropriate air quality assessment methodology. Aircraft emissions above the mixing height (or 3,000 ft. AGL when the mixing height is not identified in the applicable SIP or TIP) are exempt from study as they have been determined to be *de minimis*. 40 CFR §93.153(c)(2)(xxii); see also 75 Fed. Reg. 17257-17258 (April 5, 2010).

[36] If DNL 1.5 dB increases are documented within the DNL 65 dB for an action in the immediate vicinity of an airport, the NEPA document must also identify noise sensitive areas where noise is projected to increase by DNL 3 dB or more within the DNL 60-65 dB contours. Disclosure of noise impacts outside the DNL 65 dB contour may also be warranted in connection with the consideration of noise impacts in areas where the land use compatibility guidelines in 14 CFR part 150 may not be relevant. See FAA Order 1050.1F, Appendix B, paragraph B-1.4.

[37] See FAA Order 1050.1F, Appendix B, paragraph B-1.3; FAA Order 7400.2K, section 32-2-1.b.2.

[38] For NEPA reviews, GHG emissions should be quantified when fuel burn is computed and reported in the NEPA document. See Chapter 3 of the 1050.1F Desk Reference..

4.2 Aircraft operations and schedules

Aircraft operations are the flight schedule information input to AEDT to compute aircraft performance and affect environmental results. Inputs include fleet mix (i.e., airframe, engine), number of operations, and operational profile (i.e. the distribution of operations over time).

Aircraft operations inputs to compute noise, an emissions inventory, emissions dispersion, fuel burn, or GHG emissions may include:

- Number of operations by aircraft type in the year(s) of study;
- Fleet mix, specifying each airframe and engine, based on annual operations;
- Aircraft flight paths;
- Aircraft ground movements, represented in time and space, for emissions;
- Airport layout and capacity parameters;
- Number of day and night operations by aircraft for the Day-Night Average Sound Level (DNL) noise metric. For the Community Noise Equivalent Level (CNEL) noise metric only, also include the number of evening operations by aircraft; and
- Operational profile(s) (i.e., number of flights in the month, day, and hour or quarter-hour relative to the peak). AEDT will run the operational profiles for emissions dispersion. Information must be provided on the split between day, evening, and night operations, as appropriate for the noise metric.

As an alternative to the aircraft operations information listed above, a detailed schedule of annual operations (i.e., time-stamped flights for the year of study, which includes the fleet and operations for the entire year) may be provided. AEDT will run the detailed schedule for emissions inventory and emissions dispersion, and annualize the data to an average annual day for noise.

For an emissions dispersion analysis, AEDT's ground delay and sequencing function should be used, which models aircraft ground locations in time and space based on airport layout and capacity parameters.

If delay and sequencing is applied to the aircraft operations in a noise metric result, the scheduled and actual time for each operation should be compared to determine whether there is a change. Coordinate with the AEE-100 if there are differences between scheduled and actual times for noise operations that occur across the day and night time periods for the DNL metric or day, evening, and night time periods for the CNEL metric.

For emissions only, non-aircraft operations inputs may include:

- Auxiliary power units;
- Ground support equipment, e.g., aircraft tugs, air start units, loaders, tractors, fuel or hydrant trucks;
- Stationary sources, e.g., boilers, heaters, generators, snowmelters, incinerators, fire training facilities, fuel storage tanks, painting operations, de-icing and anti-icing operations, salt/sand storage.

4.3 Use of weather information

This section describes the use of weather data and atmospheric absorption.

4.3.1 Weather data

AEDT default weather data include average annual weather (i.e., based on 30-year normals and 10-year averages) for each airport,[39] as well as International Standard Atmosphere (ISA) conditions.[40] In addition, AEDT accepts more detailed weather data (in space and/or time). Default or more detailed weather for each airport may be selected, depending on the type of analysis.

For airport actions, AEDT default airport-specific average weather conditions should be used to compute noise for the airport to be studied. Use of non-default weather data requires written approval from AEE (see Section 5, Non-Default Methods and Data).

For air traffic airspace and procedure actions, AEDT default airport-specific average weather conditions for the airport(s) to be studied should be used to compute noise. Use of non-default weather data requires written approval from AEE (see section 5).

When emissions dispersion analysis is conducted, surface and upper air weather data must be used to compute both the emissions inventory and emissions dispersion analyses. There is no singular, standard weather data source for emissions inventory or dispersion computation. The weather data needed to compute emissions dispersion must meet EPA guidance[41] and the AERMOD format. Use of AERMET to form compliant weather input for AERMOD allows use of data sets from the NWS, on-site data, or detailed one-minute data. For example, NCDC ASOS/Upper Air format meets the requirements to compute emissions dispersion. Conduct interagency coordination to determine the appropriate weather data to use for the analysis of emissions dispersion.

The same weather source used to compute the emissions inventory of criteria pollutants should be used to compute fuel burn and CO_2 emissions.

In this use case, there could be differences between the source of weather data applied (i.e. for noise and emissions) where appropriate. Coordinate with the appropriate FAA office if there is uncertainty regarding the use of weather and its potential influence in a specific study.

4.3.2 Atmospheric absorption [noise only]

Atmospheric absorption is the calculation of the absorption of sound by the atmosphere due to weather conditions (temperature, relative humidity, atmospheric pressure, etc.). In AEDT, the airport average weather conditions in the study are used to calculate atmospheric absorption adjustments to standard Noise-Power-Distance (NPD) curves.

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[39] Data acquired from NOAA National Climatic Data Center website.

[40] The International Standard Atmosphere is an atmospheric model of how the pressure, temperature, density, and viscosity of the Earth's atmosphere change over a wide range of altitudes.

[41] US EPA, "Meteorological Monitoring Guidance for Regulatory Modeling Applications," EPA-454/R-99-005, February 2000.

For noise analyses of FAA actions, the atmospheric absorption type “*SAE-ARP-5534*” must be selected in AEDT Processing Options. This function uses the method described in Society of Automotive Engineers’ (SAE) Aerospace Recommended Practice (ARP) 5534, taking into account changes in atmospheric absorption due to airport specific temperature, relative humidity, and atmospheric pressure.

4.4 Flight paths

4.4.1 Ground track geometry

Aircraft operations are modeled on ground tracks. AEDT allows for the development of studies with ground track geometry that include both straight and curved flight paths. For analyses that include emissions inventory, emissions dispersion, and noise, modeled ground tracks should approximate actual flight paths in the study area. Coordinate with the appropriate FAA office if there is uncertainty regarding the use of ground tracks.

4.4.2 Track dispersion

Ground tracks are typically consolidated, or “bundled,” to represent average movements around an airport in an analysis. The potential effects that the modeling technique of bundling ground tracks may have on study results should be considered, as there are different implications on noise, fuel burn, and emissions results. Specifically, care should be taken to ensure that bundled ground tracks and the aircraft types that are modeled on those tracks represent actual operations in the study area in terms of flight path dispersion around the airport and the aircraft types that fly those flight paths.

4.5 Use of terrain information

AEDT allows users to import terrain files and use terrain data in emissions dispersion and noise computations. When terrain is not applied in AEDT, the model computes receptor-to-source distances in the noise and emissions dispersion calculations based on flat ground.

In regions where topography is relatively flat, use of terrain is not required for environmental studies. If there is uncertainty in the use of terrain and its potential influence on pollutant concentrations or noise exposure in a specific study, coordinate with the appropriate reviewing authority. If terrain files are used in a study that includes both emissions dispersion and noise, then the same terrain data should be applied for relevant noise and emissions dispersion metrics.

For noise analyses, terrain files can be applied with or without line-of-sight blockage. Although line-of-sight blockage is not required for environmental studies, it should be considered for analyses that have substantial terrain features located between the aircraft noise sources and the noise receptors. Coordinate with the appropriate FAA office if there is uncertainty regarding the use of line-of-sight blockage and its potential influence on noise exposure in a specific study.

4.6 Use of lateral attenuation for propeller aircraft and helicopters [noise only]

For noise analyses, lateral attenuation describes the difference in sound level between the sound directly under an aircraft's flight path and at a location to the side of the aircraft. In AEDT, the lateral attenuation adjustment is based on the methods described in the SAE Aerospace Information Report (AIR) 5662 "Method for Predicting Lateral Attenuation of Airplane Noise." It takes into account the following effects on aircraft sound due to over-ground propagation: (1) ground reflection effects; (2) atmospheric refraction effects; and (3) airplane shielding effects, as well as other ground and engine/aircraft installation effects.

AEDT assumes that sound propagation occurs over acoustically soft ground (i.e. grass/trees), which is appropriate for the majority of analyses. AEDT also has a setting to turn off lateral attenuation for flights from helicopters and propeller-driven airplanes, effectively assuming propagation over acoustically hard ground (i.e., pavement/water), while soft ground effects would still apply to other aircraft types.[42]

For noise analyses of FAA actions, lateral attenuation must be modeled for all aircraft types, including helicopters and propeller-driven airplanes, assuming acoustically soft ground (ensure that the box "*Use hard ground attenuation for helicopters and propeller aircraft*" is unchecked in AEDT Processing Options). Written approval from AEE-100 is required if the default lateral attenuation setting is not used. See section 5 on Non Default Methods and Data for information on request and approval processes.

[42] Sometimes lateral attenuation is not used when source-to-receiver propagation occurs primarily over an acoustically hard surface (e.g., water), the hard surface dominates the study environment, and there are low-altitude helicopter and propeller-driven aircraft operations.

5 Non-Default Methods and Data

Use of non-default methods or data[43] for environmental analysis[44] of FAA actions generally requires written approval from AEE. Section 5.1 describes the procedures for coordinating AEE review. Section 5.2 lists specific items that do or do not require AEE review and approval. Section 5.3 describes information required to be submitted for each type of non-default method or data.

The approval for use of non-default methods or data is limited to the particular study under consideration. The approval of particular non-default methods or data in past studies does not guarantee approval in a future study. Each modeling situation is unique and must be evaluated on a case-by-case basis. Approval should be sought prior to the start of modeling.[45]

5.1 Procedures for AEE review of non-default methods and data

Below is a description of the required steps in AEE review and approval to use non-default methods and data.

1. Initial communication between project consultant (PC), in coordination with the project sponsor (PS), and FAA project manager (PM) in the region, district office, or service center to determine if the proposed non-default methods/data require formal review by AEE. As part of this discussion, the PC should be prepared to explain the reason for the use of non-default methods/data to the PM and AEE.

2. The PC must then submit the review package (see section 5.3) to the appropriate FAA headquarters office, in coordination with the PS and PM. Information in the review package must be complete and presented in a clear manner. The information and the review process should be well-documented and may be included as an appendix to an EA, EIS, or study report as part of the NEPA documentation. The format of the review package is described in section 5.3.

3. After receiving the review package and checking it for completeness, the appropriate FAA headquarters office will forward the review package to AEE.

4. Provided the review package is complete and contains all essential information (see section 5.3), AEE will begin their review of the package. During the review period, AEE may discuss the review package, gather more facts, and clarify the technical issues directly with the PC. Unless policy implications or substantive issues arise, AEE does not need to coordinate with other FAA headquarters offices, or the PM during this period other than providing emails on the status of its review, as appropriate.

[43] Non-default methods or data are methods or data that are not set as default or are not inherent within the tool (i.e., AEDT for aircraft performance, noise, fuel burn, or emissions computation such as user-defined aircraft or flight profiles, new analytical techniques, or alternative models or methods).
[44] Guidance on coordination for Part 150 and Part 161 studies can be found in the Memorandum for AEE and Airports Coordination Policy for Non-Standard Modelling Procedures and Methodology, June 28, 2009.
[45] Preliminary analysis may be conducted to assess the need for non-default methods or data, or to include in the review package, however, approval should be sought before starting detailed modeling for NEPA reviews.

5. AEE will prepare a letter addressed to the PM providing the decision on the review package.

6. AEE will forward the decision letter to the PM with a cc: to the appropriate FAA headquarters office by email. The PM should convey the decision to the PS and PC.

7. If AEE approves the use of non-default methods or data, the following must be included in the FAA's project file: (1) a copy of AEE's approval letter; and (2) a description of the approved non-default method(s) and/or data.

Questions about the above procedures should be addressed to the appropriate FAA headquarters office, whether the questions pertain to the process or as applied to a specific project. Early and clear communications with the PS and PC will reduce the chance of delay caused by an incomplete review package.

5.2 Lists of common analysis methods/data and whether AEE review and approval is required

Sections 5.2.1 and 5.2.2 describe common analysis methods and data used to model aircraft performance, noise, fuel burn, emissions inventory and/or emissions dispersion. For information on how to request changes to methods or data not listed in either section, please contact AEE.

5.2.1 Analysis methods/data that *do not require* AEE review and approval

The following analysis methods or data *do not* require AEE review and approval.

- Default methods and data that are provided in an AEDT installation or service package, including but not limited to aircraft in the fleet database, airports in the airports database, International Standard Atmosphere (ISA) and 30-year annual average airport weather[46] data.

- AEDT's FAA-accepted methodology to create user-defined procedural profiles.

- Stage length determinations to guide the selection of standard profiles, if one of the following factors is used for those determinations:
    - Trip Length
    - Estimate of takeoff weights
    - Documented procedures based on ICAO Document 9911, SAE International Aerospace Information Report 1845, or ECAC Document 29 standards

  While AEE approval is not required, documentation of the selection and reasoning behind the stage length determination must be included in the project's NEPA documentation.

[46] See the weather section in each use case of this guidance for more information.

- Use of supplemental (i.e., other than DNL) A-weighted noise metrics that are described for possible use in the 1050.1F Desk Reference or the *Environmental Desk Reference for Airport Actions*, provided that the study only reports the resulting noise levels and does not draw any specific conclusions about impacts or suggest that the impacts are significant. Conversely, the discussion must include effective language about existing scientific uncertainties and the lack of FAA assessment methodology, impact criteria, and policy guidance in the area examined by supplemental metrics.

- Use of the First Order Approximation Version 3.0a (FOA3a) prior to AEDT version 2b modification SP3 or Version 3.0 (FOA3) with AEDT version 2b modification SP3 and beyond to calculate particulate matter emissions from aircraft.[47]

Although the above methods/data do not require approval, they should be well documented in the NEPA documentation.

5.2.2 Analysis methods/data that *require* AEE review and approval

The following analysis methods or data require AEE review and approval.

- Sensitivity
    - Any supplemental noise analysis that involves impacts that are likely to be highly controversial on environmental grounds.[48]
    - Any supplemental noise analysis that involves Section 4(f) properties (including, but not limited to, noise-sensitive areas within national parks; national wildlife and waterfowl refuges; and historic sites including traditional cultural properties) where a quiet setting is a generally recognized purpose and attribute.
- Supplemental noise metrics
    - A-weighted noise metrics that are not listed in the Desk Reference or the *Environmental Desk Reference for Airport Actions*.
    - Interpretation of impacts or significance for supplemental A-weighted noise metrics that are listed in the Desk Reference or the *Environmental Desk Reference for Airport Actions*.
    - Supplemental noise analysis that is focused on one or more secondary or indirect effects (e.g., sleep disturbance, health effects, classroom learning, low frequency impacts), regardless of the supplemental metric(s) used.
    - Any noise metrics that are not A-weighted (e.g., Time Audible and frequency-based metrics, C-weighted metrics, etc.).
- Aircraft profiles and model mappings

[47] N.B.: FOA3a is the only available method in AEDT 2b for calculating particulate matter emissions from aircraft, while FOA3 is the only available method in AEDT 2c.

[48] The impacts of an action are considered “highly controversial on environmental grounds” when reasonable disagreement exists over the project’s risks of causing environmental harm. Mere opposition to a project is not sufficient to be considered highly controversial on environmental grounds. Opposition on environmental grounds by a Federal, state, or local government agency or by a tribe or a substantial number of the persons affected by the action should be considered in determining whether or not reasonable disagreement regarding the impacts of a proposed action exists. If in doubt about whether a proposed action is highly controversial on environmental grounds, consult the LOB/SO’s headquarters environmental division, AEE, Regional Counsel, or AGC for assistance. See FAA Order 1050.1F, paragraph 5-2.b.(10).

    - Aircraft that do not exist in AEDT default data.
    - Aircraft where model mappings (performance, noise, or engine emissions) are changed.
    - User-defined aircraft profiles (including modifications to standard profiles) developed by methods other than AEDT's FAA-accepted methodology.
    - Helicopter operations that do not follow AEDT-defined profiles and parameters.
    - Radar-based or other methods not listed in section 5.2.1 for adjusting stage lengths.
- Non-default weather data used for the analysis of noise. See the weather section in each use case of this guidance for more information.
- Use of a method other than the First Order Approximation Version 3.0a (FOA3a) or Version 3.0 (FOA3) to calculate particulate matter emissions from aircraft.
- Non-default emissions area source grid size.
- Alternative models and methodologies besides FAA-required and -preferred models and methodologies (e.g., terrain shielding, adjustments to lateral attenuation, etc.), including modifications to AEDT default methodologies.

5.3 Information to include in requests to use non-default methods/data

The following information is always required for any request to use non-default methods or data:

1. *Background*. Briefly describe the project, including location, for which non-default methods or data are needed. State the type of analysis (e.g., Environmental Assessment (EA), Environmental Impact Statement (EIS), or other type of NEPA analysis). Include any additional relevant information.
2. *Statement of Benefit*. Briefly describe why the non-default methods or data are needed for this project, how the non-default methods or data are more appropriate, and why the default method or data are not sufficient.

The sections below discuss the *additional* specific information required to be submitted for specific types of non-default methods or data.

5.3.1 User-defined aircraft and aircraft mappings

The default aircraft mappings provided in AEDT are recommended by the FAA for use in NEPA analyses of FAA actions. However, AEDT allows for the creation of user-defined aircraft and to specify aircraft mappings that differ from default data provided in AEDT. If modelers use aircraft or aircraft mappings that are not part of AEDT for noise analyses, AEE approval is required (see section 5.2.2).

Additional information to include in a submittal package requesting AEE approval for use of user-defined aircraft or aircraft mappings:

1. *Aircraft Information*. If requesting use of a new aircraft, submit an AEDT Data Submittal Form.[49] If requesting use of a different aircraft mapping, provide the following information in table form for both the original aircraft and the mapping aircraft.

[49] To obtain the AEDT Data Submittal form for aircraft noise and performance, contact AEDT Support at aedt-support@dot.gov.

- Manufacturer Type
- Type Designation
- Maximum Take-off Weight (MTOW) (lb)
- Maximum Landing Weight (MLW) (lb)
- Engine static thrust
- Engine Manufacturer /Type Designation
- Certification Noise: Fly Over, Lateral, and Approach
- Engine emissions indices (optional)[50]
- Fuel consumption coefficients
- Percentage of operation (optional)

For user-defined helicopters, also include:

- Number of main rotor blades
- Main rotor diameter (ft)
- Rotor speed (RPM)
- Number of rotors (main plus tail)
- Maximum speed in level flight with maximum continuous power, VH (kt)
- Never Exceed Speed, VNE (kt)
- Does the helicopter have wheels (Yes/No)?

An example table is provided for reference:

User-Defined Aircraft	"Mapped" Aircraft in AEDT	Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Static Thrust	Engine Manufacturer / Type Designation	Fly Over Noise Level (EPN dB)	Lateral Noise Level (EPN dB)	Approach Noise Level (EPN dB)	Engine Emissions Index	Fuel Burn Coefficient	% Operations

5.3.2 User-defined profiles

AEDT provides standard profiles that are appropriate for most studies. In certain situations, where a more detailed profile is needed and procedural profiles are provided as input, AEDT has an FAA-accepted methodology to create user-defined profiles. AEDT calculates flight paths for civilian jet, turboprop, and piston aircraft within the limits of a given aircraft's performance characteristics and based on altitude controls set by the modeler. If modelers use AEDT to develop profiles, then AEE approval is not required (see section 5.2.1). If standard profiles and AEDT cannot provide the profiles needed for the study, then approval from AEE to develop user-defined profiles (or custom stage lengths) based on a different method (see section 5.2.2) must be requested.

Additional information to include in a submittal package requesting AEE approval for user-defined profiles (non-AEDT method):

[50] An emissions index (or emissions factor) is a representative value that relates the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Generally, emissions indices are expressed as pounds of pollutant per 1,000 pounds of fuel consumed.

1. *Analysis Demonstrating Change*

   For departure tracks, provide Sound Exposure Level (SEL) values for a noise receptor network spaced 0.5 nautical miles apart underneath the flight path, beginning at the start of takeoff roll and ending at the end of the profile, or at 10 nautical miles from the start of takeoff roll (whichever is shorter). For arrival tracks, place the noise receptors 0.5 nautical miles apart underneath the flight path, beginning at the start of the profile, or at 10 nautical miles away from the runway threshold (whichever is shorter), and ending at the last point of the landing roll-out on the runway. Also include noise receptors for any noise sensitive areas.

   Fuel burn, emissions, and emissions dispersion results are not needed in the submittal package because differences in these results from an individual user-defined profile (compared to standard profiles) are considered to be insignificant in comparison with the total fuel burn, emissions inventories, and pollutant concentrations up to the mixing height resulting from all aircraft activity in a given study.

   Interpret the results of the analysis and explain how the results correlate with the "Statement of Benefit". For each profile, provide a table with the following information. Submit with the AEDT Administrative File, which includes study information used to perform the above analysis.

   AEDT Aircraft Model ____________ Profile Weight ________________

	AEDT Default Profile	User-Defined Profile	Difference
Noise Receptors (nmi) 0.5 1.0 1.5 2.0 … 10.0	(SEL dB)	(SEL dB)	(dB)
Noise Sensitive Areas x_1, y_1 x_2, y_2 … x_n, y_n	(SEL dB)	(SEL dB)	(dB)

2. *Concurrence on Aircraft Performance*. In this section, obtain verification from an airline operator or aircraft manufacturer familiar with the performance characteristics of the aircraft. This verification could be either:
   a. A description of the performance characteristics of the aircraft, such as a profile description copied from a flight manual. Define all abbreviations and terms used on the copied material. Or,

   b. A statement by the operator or manufacturer certifying that the proposed profile falls within reasonable bounds of the aircraft's performance for the modeled airport location.

3. *Performance Characteristics*. State that the aircraft performance characteristics submitted by the operator or manufacturer have been correctly translated into the AEDT formatted profile or procedure. Specifically, certify that:

   If the new profiles are in terms of profile points:
   a. Altitude is AFE in feet.
   b. Speed is true airspeed in knots.
   c. State the units of thrust-setting (for example, pounds). State that the units match the units of the thrust-setting parameter used in the aircraft's associated noise-power-distance curves.

   If the new profiles are defined in terms of procedure steps:
   a. If new aircraft performance coefficient data were developed, separate AEE review is required. In addition, direct manufacturer support or flight test information is required to facilitate that review.
   b. The procedure step data must conform to the profile rules given in the AEDT ASIF Reference Guide.
   c. If percent units are used for thrust-setting, give the value of the aircraft's static thrust parameter used in the denominator when calculating percent. State that this value is in units of pounds.
   d. If the profile thrust setting is in terms of Revolutions per Minute (RPM), Exhaust Pressure Ratio (EPR), N1 or other parameters, show the method for converting thrust to pounds.

4. *Graphical and Tabular Comparison*. Provide three graphics for each proposed change in profile in each seat class:
   a. Altitude vs. Distance
   b. Speed vs. Distance
   c. Thrust vs. Distance

   Plot the default profiles and the proposed user-defined profiles on the same graph. Also, submit tables of information used to plot the graphs. Quantitative comparison, such as an estimate of the least mean square of differences, should be provided and explained.