Aviation Environmental Design Tool (AEDT)

Supplemental Manual

Background Concentrations in AEDT

October 2017

Introduction

The FAA's Office of Environment and Energy (AEE) has developed Aviation Environmental Design Tool (AEDT) as a software system designed to dynamically model aircraft performance in space and time to compute noise, emissions, and fuel consumption. A primary objective of the AEDT application is to help the analyst efficiently answer questions of interest about the environmental consequences of aviation activity. These environmental consequences are evaluated through metrics, many of which are defined by regulatory standards. AEDT replaced the Emissions and Dispersion Modeling System (EDMS) as the preferred model for conducting airport emissions inventory and air quality analyses. Further information can be found at the AEDT website, http://aedt.faa.gov/.

AEDT has the capability of including background concentrations in a user's study. Background concentrations are pollutant concentrations originating from sources not explicitly defined in the analysis. Concentrations that consider both the sources entered through AEDT and the background concentration data are modeled using AERMOD directly through the AEDT interface in support of conducting National Environmental Protection Act (NEPA) and general conformity analyses.

The purpose of this document is to provide information on appropriately using background concentrations with modeled concentrations for comparison to the National Ambient Air Quality Standards (NAAQS) (1) for airport air quality dispersion analyses using AEDT. Background concentrations can be obtained from nearby monitors that are representative of the area being modeled. In some instances state or local environmental agencies will have background concentrations that are to be used when assessing air quality impacts.

The Environmental Protection Agency (EPA) defines a Design Value (DV) as "a statistic that describes the air quality status of a given location relative to the level of the NAAQS" (2). For an analyst to evaluate the effect that a given project will have on the air quality status of a given location, the sum of the background concentrations and modeled concentrations can be used to compute a DV for the project. Background concentrations for a particular pollutant will be based on monitoring data from a representative location relative to the project being analyzed. However, there is guidance from the EPA on using background concentrations for determining DVs for specific NAAQS which is further discussed in this document. Any analyst who uses background concentrations to determine DVs for an airport study should rely on interagency coordination to determine the appropriateness of those background concentrations when comparing to the NAAQS. For further information on air quality dispersion modeling for airport analyses please refer to the *Aviation Emissions and Air Quality Handbook* (3).

AEDT Background Concentration Options

AEDT enables the analyst to utilize the background concentration option within AERMOD for use with conducting air quality dispersion analyses for airport studies. Please refer to the AEDT

Technical Manual and the AEDT User Guide for specific details on the background concentration implementation in AEDT.

AEDT allows the analyst to specify background concentrations for the following temporal variations.

- Hourly – Hourly background values paired with meteorological data for every hour being modeled. The analyst must provide a background concentration for every hour of meteorological data being modeled.
- Annual – annual background value (1 value)
- Season – background values vary seasonally (4 values)
- Month – background values vary monthly (12 values)
- Hour of Day – background values vary by hour-of-day (24 values)
- Season and Hour of Day – background values vary by season and hour-of-day (96 values)
- Hour of Day and Day of Week – background values vary by hour-of-day, and day-of-week [M-F, Sat, Sun] (72 values)
- Hour of Day and Seven Days of the week – background values vary by hour-of-day, and the seven days of the week [M, Tu, W, Th, F, Sat, Sun] (168 values)
- Season, Hour of Day, and Days of Week – background values vary by season, hour-of-day, and day-of-week [M-F, Sat, Sun] (288 values)
- Season, Hour of Day, and Seven days of the Week – background values vary by season, hour-of-day, and the seven days of the week [M, Tu, W, Th, F, Sat, Sun] (672 values)
- Month, Hour of Day, and Days of Week – background values vary by month, hour-of-day, and day-of-week [M-F, Sat, Sun] (864 values)
- Month, Hour of Day and Seven Days of the Week – background values vary by month, hour-of-day, and the seven days of the week [M, Tu, W, Th, F, Sat, Sun] (2,016 values).

AEDT allows the analyst to utilize both hourly background concentrations and temporally varying background concentrations or wind speed varying background concentrations. The temporally varying background concentrations are used in the event that there are any missing hourly background concentrations.

When only using non-hourly background concentrations in AEDT, the non-hourly background concentration values that are specified by the user will be applied to all averaging periods being modeled. For example, when choosing the CO Emissions Dispersion metric result, AEDT will output concentrations for the 1-hour and 8-hour averaging periods. If the analyst is applying non-hourly background concentrations that represent an 8 hour average for CO, those values will be applied to both the 1-hour and 8-hour output concentrations.

AERMOD is not capable of specifying separate non-hourly background concentrations for different averaging times in a single model run. To apply separate non-hourly background concentrations for different pollutant averaging times, the analyst may either want to apply the background concentrations post process or run a separate Emissions Dispersion metric result for

the pollutant averaging time desired. This does not apply to hourly background concentrations since AERMOD will automatically apply the averaging time for each pollutant being modeled.

AERMOD also supports the ability to specify background concentrations by wind speed. AEDT supports the ability to change the wind speed category.

EPA Guidance on Using Background Concentrations with AERMOD

Although AERMOD has the ability to specify background concentrations to obtain DVs to compare with the NAAQS, interagency coordination should be conducted when using any background concentrations with AEDT. In some cases the state or local environmental agency will already have background concentrations that are to be used for calculating DVs in area of the project. However, in other instances, the project may require that on-site monitoring data of background concentrations be used for determining DVs. Please refer to Title 40 of the Code of Federal Regulations Part 50 (40 CFR Part 50) for information on properly calculating DVs from background concentrations for all criteria pollutants. Guidance on the use of background concentrations for specific pollutants and their respective averaging periods for developing DVs is available from the EPA (www.epa.gov). The current EPA guidance should be followed when using background concentrations with AEDT. The EPA has issued additional clarification and guidance on using background concentrations for the NAAQS listed below.

24-Hour PM$_{2.5}$ Guidance

The EPA recommends either a "First Tier" or "Second Tier" approach for using background concentrations to calculate DVs for PM$_{2.5}$ NAAQS compliance. The "First Tier" approach is a more conservative approach for calculating DVs where the highest modeled 24-hour average concentration is utilized with the background concentration DV for assessing 24-hour PM$_{2.5}$ NAAQS compliance. The "Second Tier" approach allows for usage of a combination of modeled and monitored concentrations on a seasonal or quarterly basis for assessing 24-hour PM$_{2.5}$ NAAQS compliance.

Please refer to the following EPA guidance for more information on using background concentrations for calculating DVs.

- *Modeling Procedures for Demonstrating Compliance with the PM$_{2.5}$ NAAQS* (4)
- *Guidance for PM$_{2.5}$ Permit Modeling* (5)

1-Hour NO$_2$ Guidance

The EPA has issued three documents regarding the demonstration of NO$_2$ NAAQS compliance.
- *Applicability of Appendix W Modeling Guidance for the 1-hour NO$_2$ NAAQS* (6)
- *Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO$_2$ NAAQS* (7)
- *Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO$_2$ National Ambient Air Quality Standard* (8)

Each of these documents discusses using background concentrations to demonstrate NO$_2$ NAAQS compliance. In those guidance documents, the EPA specifies a "First Tier" and "Second Tier" approach for demonstrating NO$_2$ NAAQS compliance. The "First Tier" approach allows for the DV from the most recent three years of monitoring data be combined with the DV from the five years of modeled data or 1 year of site specific modeled data for assessing 1-hour NO$_2$ NAAQS compliance. The "Second Tier" approach allows for the use of background concentrations with seasonal and hour of day variation to be added to the modeled DV for assessing 1-hour NO$_2$ NAAQS compliance. Further detail is offered in the EPA guidance documentation if a more refined approach is required to demonstrate NO$_2$ NAAQS compliance.

1-Hour SO$_2$ Guidance

For SO$_2$, the EPA recommends a "First Tier" approach using the highest monitored background concentration and adding that to the modeled DV to demonstrate SO$_2$ NAAQS compliance. A less conservative "Refined First Tier" approach based upon temporally varying background concentrations is also discussed but would require interagency coordination for that approach. Please refer to the following the EPA guidance for using background concentrations for calculating DVs for SO$_2$ NAAQS compliance.

- *Applicability of Appendix W Modeling Guidance for the 1-hour SO$_2$ NAAQS* (9)

References

1. Environmental Protection Agency (EPA), National Ambient Air Quality Standards, https://www.epa.gov/criteria-air-pollutants/naaqs-table

2. Environmental Protection Agency (EPA), National Air Quality: Status and Trends of Key Air Pollutants. Retrieved October 7, 2016. https://www.epa.gov/air-trends/air-quality-design-values

3. Federal Aviation Administration (FAA), Aviation Emissions and Air Quality Handbook Version 3 Update 1, DOT/FAA/AEE/2015-01, January 2015, https://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/media/Air_Quality_Handbook_Appendices.pdf

4. Environmental Protection Agency (EPA), Memo: Modeling Procedures for Demonstrating Compliance with the $PM_{2.5}$ NAAQS, March 23, 2010, Office of Air Quality Planning and Standards, https://www3.epa.gov/scram001/guidance/clarification/Official%20Signed%20Modeling%20Proc%20for%20Demo%20Compli%20w%20PM2.5.pdf

5. Environmental Protection Agency (EPA), Guidance for $PM_{2.5}$ Permit Modeling, EPA-454/B-14-001, May 2014, https://www3.epa.gov/scram001/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf

6. Environmental Protection Agency (EPA), Memo: Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard, June 28, 2010, Office of Air Quality Planning and Standards, https://www3.epa.gov/scram001/guidance/clarification/ClarificationMemo_AppendixW_Hourly-NO2-NAAQS_FINAL_06-28-2010.pdf

7. Environmental Protection Agency (EPA), Additional Clarification Regarding Application of Appendix W Modeling Guidance for the I-hour NO_2 ,National Ambient Air Quality Standard, March 1, 2011, Office of Air Quality Planning and Standards, https://www.epa.gov/sites/production/files/2015-07/documents/appwno2_2.pdf

8. Environmental Protection Agency (EPA), Memo: Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard, September 30, 2014, Office of Air Quality Planning and Standards, https://www3.epa.gov/scram001/guidance/clarification/NO2_Clarification_Memo-20140930.pdf

9. Environmental Protection Agency (EPA), Memo: Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010, Office of Air Quality Planning and Standards, https://www3.epa.gov/scram001/guidance/clarification/ClarificationMemo_AppendixW_Hourly-SO2-NAAQS_FINAL_08-23-2010.pdf