



U.S. Department  
of Transportation  
Federal Aviation  
Administration

# Aviation Environmental Design Tool (AEDT)

## Supplemental Manual

### Background Concentrations in AEDT

May 2022



## 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 Manual for specific details on the background concentration implementation in AEDT.

AEDT allows the analyst to specify background concentrations for the following 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
- Season – background values vary seasonally
- Month – background values vary monthly
- Hour of Day – background values vary by hour-of-day
- Wind Speed – background values vary by wind speed bin
- Season and Hour of Day – background values vary by season and hour-of-day
- Hour of Day and Day of Week – background values vary by hour-of-day, and day-of-week [M-F, Sat, Sun]
- 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]
- Season, Hour of Day, and Days of Week – background values vary by season, hour-of-day, and day-of-week [M-F, Sat, Sun]
- 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]
- Month, Hour of Day, and Days of Week – background values vary by month, hour-of-day, and day-of-week [M-F, Sat, Sun]
- 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]

Additionally, AEDT allows the analyst to vary the background concentrations by wind sector (up to six sectors). Once the Enable background concentration option is selected, the analyst can click the Add button (see below) to add multiple wind sectors.

**Background Concentrations**

Enable background concentrations

Wind sectors

Click to add more wind sectors Units: ppm

Wind sector 1

Start: 0.00 End: 60

Hourly file

Non-hourly

Annual:

Use file

Type:

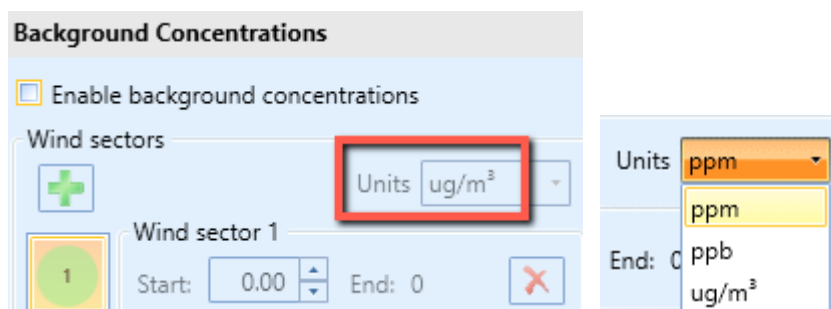
Each wind sector can be specified with a starting and ending angle (from vertical). Note, the analyst will be required to provide a background concentration using one of the 13 variation options above for each wind sector.

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. Note, missing hourly background concentrations without temporally varying background concentrations (to substitute missing data) will result in a fatal AERMOD error.

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.

Background concentrations are to be input by the analyst in units of micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). However, CO, NO<sub>2</sub>, and SO<sub>2</sub> can instead be input in units of parts per billion (ppb) or parts per million (ppm). The units for these three pollutants can be set by the analyst in the Set Processing Options screen within the Define Metric Results wizard (see below).



If the analyst checks the “Enable background concentrations” option and the metric result is for CO, NO<sub>2</sub>, or SO<sub>2</sub>, then the Units option will become available for the analyst to select the units that match the input concentrations. Note, background concentrations specified in units of ppb or ppm will be converted in AERMOD to  $\mu\text{g}/\text{m}^3$  using a reference temperature and pressure of 25°C and 1013.25 millibars, respectively.

## Input File Formatting for Background Concentrations

Text files can be used to bring hourly and non-hourly background concentrations into AEDT. The required format and specific inputs needed are dependent on the form of the background concentration. Following are examples for each of the available background concentration input forms. Note that the examples below include a header, but these are for information purposes only – headers should not be included in the input file unless the line is preceded by a pound sign (#) which signifies that the line should be skipped when read into AEDT.

### *Hour*

For analysts using an hourly background concentration file, the hourly background file must be a comma-delimited text file and include the year, month, day, and hour, followed by the background concentration, in that order. The year can be specified as either 2 or 4 digits. An example hourly background concentration file would consist of the following information:

	Year	Month	Day	Hour	Concentration
Each hour on a new row →	19	2	15	1	16
	19	2	15	2	15
	19	2	15	3	16

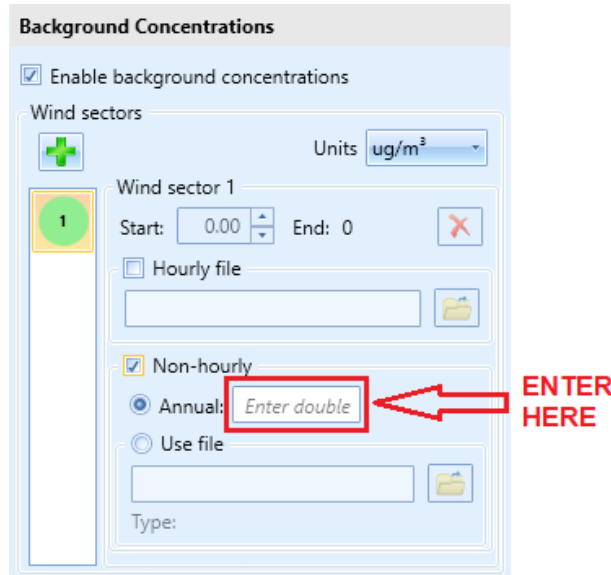
representing the first three hours of February 15, 2019, with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows:

```
# header in text file is allowed if line is preceded by the pound sign
# year,month,day,hour,concentration
19,2,15,1,16
19,2,15,2,15
19,2,15,3,16
```

For a full year, a total of 8,760 values would be included (8,784 for a leap year). To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Hourly file option and browse for the text file.

### *Annual*

A separate input file for an annual background concentration is not necessary for AEDT. Once the Enable background concentration option is selected, the analyst can check the Non-hourly option, select Annual, and input an annual background concentration into the adjacent box (see below).



The value entered should be in the same units as selected for the Units option.

*Season*

For analysts using a seasonal background concentration file, the file must be a comma-delimited text file and include background concentrations for winter (Dec., Jan., Feb.), spring (Mar., Apr., May), summer (Jun., Jul., Aug.), and fall (Sep., Oct., Nov.), in that order. An example seasonal background concentration file would consist of the following information:

	<b>Winter Concentration</b>	<b>Spring Concentration</b>	<b>Summer Concentration</b>	<b>Fall Concentration</b>
Concentrations by season on a single line →	30	25	15	23

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows:

```
# header in text file is allowed if line is preceded by the pound sign
# winter,spring,summer,fall
30,25,15,23
```

All 4 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

*Month*

For analysts using a monthly background concentration file, the file must be a comma-delimited text file and include background concentrations for all 12 months in order, starting with January. An example monthly background concentration file would consist of the following information:

	Jan Conc.	Feb Conc.	Mar Conc.	Apr Conc.	May Conc.	Jun Conc.	Jul Conc.	Aug Conc.	Sep Conc.	Oct Conc.	Nov Conc.	Dec Conc.
Conc. by month on a single line →	15	14	12	10	10	10	8	11	13	16	16	15

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows:

```
# header in text file is allowed if line is preceded by the pound sign
# concentrations by month in order starting with January
15,14,12,10,10,10,8,11,13,16,16,15
```

All 12 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

*Hour of Day*

For analysts varying background concentration by hour of day, the input file must be a comma-delimited text file and include background concentrations for all 24 hours of the day, starting with Hour 1. An example hour-of-day background concentration file would consist of the following information:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Conc. by hour of day on a single line →	5	4	2	1	0	0	2	3	3	6	6	5	5	4	5	7	9	9	9	8	7	6	6	5

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows:

```
# header in text file is allowed if line is preceded by the pound sign
# concentrations by consecutive hour of the day starting at Hour 1
5,4,2,1,0,0,2,3,3,6,6,5,5,4,5,7,9,9,9,8,7,6,6,5
```

All 24 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

### Wind Speed

For analysts varying background concentration by wind speed, the file must be a comma-delimited text file and include background concentrations for six wind speed bins. The upper bounds for the first five bins are 1.54, 3.09, 5.14, 8.23, and 10.8 meters per second (m/s) by default. The sixth bin has no upper limit. AEDT does support the ability to modify these default values. An example wind-speed varying background concentration file would consist of the following information:

	Wind Speed Bin A Conc.	Wind Speed Bin B Conc.	Wind Speed Bin C Conc.	Wind Speed Bin D Conc.	Wind Speed Bin E Conc.	Wind Speed Bin F Conc.
Concentrations by wind speed bin on a single line →	30	25	15	14	10	5

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows:

```
# header in text file is allowed if line is preceded by the pound sign
# concentration by wind speed bin
30,25,15,14,10,5
```

All 6 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

### Season and Hour of Day

For analysts using a background concentration that varies by season and hour of day, the background file must be a comma-delimited text file and include background concentrations for all 24 hours of the day, starting with Hour 1, for each season. Hour-of-day concentrations for different seasons are entered into separate rows, with winter (Dec., Jan., Feb.) first, followed by spring (Mar., Apr., May), followed by summer (Jun., Jul., Aug.), followed by fall (Sep., Oct., Nov.). An example background concentration file that varies concentrations by season and hour of day would consist of the following information (note the “...” denote data for Hours 4 thru 23, which are excluded for readability):

	Hour 1	Hour 2	Hour 3	...	Hour 24	
Each season on a new row	Winter →	12	13	12	...	10
	Spring →	15	16	17	...	15
	Summer →	20	23	26	...	19
	Fall →	17	17	18	...	18

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows (“...” from table above filled in with concentration data):



```
# header in text file is allowed if line is preceded by the pound sign
# concentrations by consecutive hour of the day starting at Hour 1 by season
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
```

All 96 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

*Hour of Day and Day of Week*

For analysts using a background concentration that varies by hour of day and day of week, the background file must be a comma-delimited text file and include background concentrations for all 24 hours of the day, starting with Hour 1, for weekdays (Mon-Fri), Saturday, and Sunday. Note that these values do not vary by season. Hour-of-day concentrations for different days of the week are entered into separate rows, with weekdays (as one group) first, followed by Saturday, followed by Sunday. An example background concentration file that varies concentrations by hour of day and day of week would consist of the following information (note the “...” denote data for Hours 4 thru 23, which are excluded for readability):

		Hour 1	Hour 2	Hour 3	...	Hour 24
<i>Each day</i>	Mon-Fri →	12	13	12	...	10
<i>of week on</i>	Saturday →	15	16	17	...	15
<i>a new row</i>	Sunday →	20	23	26	...	19

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows (“...” from table above filled in with concentration data):

```
# header in text file is allowed if line is preceded by the pound sign
# concentrations by consecutive hour of the day starting at Hour 1 by day of week
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
```

All 72 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

*Hour of Day and Seven Days of the Week*

For analysts using a background concentration that varies by hour of day and all seven days of the week, the background file must be a comma-delimited text file and include background concentrations for all 24 hours of the day, starting with Hour 1, for each day of the week. Note that these values do not vary by season. Hour-of-day concentrations for different days of the week are entered into separate rows, with Monday first, followed by Tuesday, and so on. An example background concentration file that varies concentrations by hour of day and day of the

week would consist of the following information (note the “...” denote data that were excluded for readability – Hours 4 through 23 and Thursday through Saturday):

		Hour 1	Hour 2	Hour 3	...	Hour 24
<i>Each day of the week on a new row</i>	Monday →	12	13	12	...	10
	Tuesday →	15	16	17	...	15
	Wednesday →	20	23	26	...	19
	... →	...	...	...	...	...
	Sunday →	17	17	18	...	18

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows (“...” from table above filled in with concentration data):

```
# header in text file is allowed if line is preceded by the pound sign
# concentrations by consecutive hour of the day starting at Hour 1 by day of the week
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
```

All 168 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

*Season, Hour of Day, and Days of Week*

For analysts using a background concentration that varies by season, hour of day, and day of week, the background file must be a comma-delimited text file and include background concentrations for all 24 hours of the day, starting with Hour 1, for weekdays (Mon-Fri), Saturday, and Sunday, by season. Hour-of-day concentrations for different days of the week, by season, are entered into separate rows, with winter weekdays (as one group) first, followed by winter Saturdays, then winter Sundays, then spring weekdays (as one group), and so on. An example background concentration file that varies concentrations by season, hour of day, and day of week would consist of the following information (note the “...” denote data that were excluded for readability – Hours 4 through 23):

			Hour 1	Hour 2	Hour 3	...	Hour 24
<i>Each day of week on a new row within each season</i>	Winter (Dec, Jan, Feb)	Mon-Fri →	12	13	12	...	10
		Saturday →	15	16	17	...	15
		Sunday →	20	23	26	...	19
	Spring (Mar, Apr, May)	Mon-Fri →	12	13	12	...	10
		Saturday →	15	16	17	...	15
		Sunday →	20	23	26	...	19
	Summer (Jun, Jul, Aug)	Mon-Fri →	12	13	12	...	10
		Saturday →	15	16	17	...	15
		Sunday →	20	23	26	...	19
	Fall (Sep, Oct, Nov)	Mon-Fri →	12	13	12	...	10
		Saturday →	15	16	17	...	15
		Sunday →	20	23	26	...	19

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows (“...” from table above filled in with concentration data):

```
# header in text file is allowed if line is preceded by the pound sign
# concentrations by consecutive hour of the day starting at Hour 1 by day of week and season
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
```

All 288 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

*Season, Hour of Day, and Seven Days of the Week*

For analysts using a background concentration that varies by season, hour of day, and all seven days of the week, the background file must be a comma-delimited text file and include background concentrations for all 24 hours of the day, starting with Hour 1, for each day of the week, by season. Hour-of-day concentrations for different days of the week are entered into separate rows, with Monday first, followed by Tuesday, and so on. Hour-of-day concentrations for different days of the week, by season, are entered into separate rows, with winter Mondays first, followed by winter Tuesdays, then winter Wednesdays, and so on with the remaining seasons entered in order of spring, summer, and fall. An example background concentration file

that varies concentrations by season, hour of day, and day of the week would consist of the following information (note the “...” denote data that were excluded for readability – Hours 4 through 23 and Thursday through Saturday):

			Hour 1	Hour 2	Hour 3	...	Hour 24
<i>Each day of the week on a new row within each season</i>	Winter (Dec, Jan, Feb)	Monday →	12	13	12	...	10
		Tuesday →	15	16	17	...	15
		Wednesday →	20	23	26	...	19
		... →	...	...	...	...	...
		Sunday →	17	17	18	...	18
	Spring (Mar, Apr, May)	Monday →	12	13	12	...	10
		Tuesday →	15	16	17	...	15
		Wednesday →	20	23	26	...	19
		... →	...	...	...	...	...
		Sunday →	17	17	18	...	18
	Summer (Jun, Jul, Aug)	Monday →	12	13	12	...	10
		Tuesday →	15	16	17	...	15
		Wednesday →	20	23	26	...	19
		... →	...	...	...	...	...
		Sunday →	17	17	18	...	18
	Fall (Sep, Oct, Nov)	Monday →	12	13	12	...	10
		Tuesday →	15	16	17	...	15
		Wednesday →	20	23	26	...	19
		... →	...	...	...	...	...
		Sunday →	17	17	18	...	18

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows (“...” from table above filled in with concentration data):

```
# header in text file is allowed if line is preceded by the pound sign
# concentrations by consecutive hour of the day starting at Hour 1 by day of week and season
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
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All 672 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

*Month, Hour of Day, and Days of Week*

For analysts using a background concentration that varies by month, hour of day, and day of week, the background file must be a comma-delimited text file and include background concentrations for all 24 hours of the day, starting with Hour 1, for weekdays (Mon-Fri), Saturday, and Sunday, by month. Hour-of-day concentrations for different days of the week, by month, are entered into separate rows, with January weekdays (as one group) first, followed by January Saturdays, then January Sundays, then February weekdays (as one group), and so on with the remaining months entered in consecutive order. An example background concentration file that varies concentrations by month, hour of day, and day of week would consist of the following information (note the “...” denote data that were excluded for readability – Hours 4 through 23 and months March through November):

			Hour 1	Hour 2	Hour 3	...	Hour 24
<i>Each day of week on a new row within each month</i>	January	Mon-Fri →	12	13	12	...	10
		Saturday →	15	16	17	...	15
		Sunday →	20	23	26	...	19
	February	Mon-Fri →	12	13	12	...	10
		Saturday →	15	16	17	...	15
		Sunday →	20	23	26	...	19
	...	Mon-Fri →	...	...	...	...	...
		Saturday →	...	...	...	...	...
		Sunday →	...	...	...	...	...
	December	Mon-Fri →	12	13	12	...	10
		Saturday →	15	16	17	...	15
		Sunday →	20	23	26	...	19

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows (“...” from table above filled in with concentration data):

```
# header in text file is allowed if line is preceded by the pound sign
# concentrations by consecutive hour of the day starting at Hour 1 by day of week and month
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
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20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19

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All 864 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

#### *Month, Hour of Day, and Seven Days of the Week*

For analysts using a background concentration that varies by month, hour of day, and all seven days of the week, the background file must be a comma-delimited text file and include background concentrations for all 24 hours of the day, starting with Hour 1, for each day of the week, by month. Hour-of-day concentrations for different days of the week are entered into separate rows, with Monday first, followed by Tuesday, and so on. Hour-of-day concentrations for different days of the week, by month, are entered into separate rows, with January Mondays first, followed by January Tuesdays, then January Wednesdays, and so on with the remaining months entered in consecutive order. An example background concentration file that varies concentrations by month, hour of day, and day of the week would consist of the following information (note the “...” denote data that were excluded for readability – Hours 4 through 23, Thursday through Saturday, and months March through November):

		Hour 1	Hour 2	Hour 3	...	Hour 24	
<i>Each day of the week on a new row within each month</i>	January	Monday →	12	13	12	...	10
		Tuesday →	15	16	17	...	15
		Wednesday →	20	23	26	...	19
		... →	...	...	...	...	...
		Sunday →	17	17	18	...	18
	February	Monday →	12	13	12	...	10
		Tuesday →	15	16	17	...	15
		Wednesday →	20	23	26	...	19
		... →	...	...	...	...	...
		Sunday →	17	17	18	...	18
	...	Monday →	...	...	...	...	...
		Tuesday →	...	...	...	...	...
		Wednesday →	...	...	...	...	...
		... →	...	...	...	...	...
		Sunday →	...	...	...	...	...
	December	Monday →	12	13	12	...	10
		Tuesday →	15	16	17	...	15
		Wednesday →	20	23	26	...	19
		... →	...	...	...	...	...
		Sunday →	17	17	18	...	18

with concentration in units of  $\mu\text{g}/\text{m}^3$  (or ppm or ppb if specified by the analyst for CO, NO<sub>2</sub>, or SO<sub>2</sub>). This information would be written in the text file as follows (“...” from table above filled in with concentration data):

# header in text file is allowed if line is preceded by the pound sign  
# concentrations by consecutive hour of the day starting at Hour 1 by day of week and month  
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10  
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15  
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19  
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18  
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10  
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15  
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19  
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18  
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10  
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15  
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19  
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18  
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10  
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15  
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19  
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18

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12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18
12,13,12,13,14,12,14,12,13,14,9,9,9,8,7,6,6,5,8,8,9,9,10,10
15,16,17,13,14,12,5,4,5,7,9,13,9,8,7,6,7,5,8,8,9,9,14,15
20,23,26,13,14,12,13,14,12,7,9,9,12,8,7,6,9,5,18,18,19,19,15,19
17,17,18,13,14,12,12,13,14,12,9,9,9,8,7,6,6,5,8,8,9,19,17,18

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All 2,016 values are required for this variation option. To import the text file into AEDT, the analyst would first check the Enable background concentration option and select the appropriate units. Then, check the Non-hourly option, select the Use file option, and browse for the text file.

## **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 the 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. 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](http://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<sub>2.5</sub> Guidance**

The EPA recommends either a “First Tier” or “Second Tier” approach for using background concentrations to calculate DVs for PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> NAAQS compliance. Refer to the following EPA guidance documents for more information on using background concentrations for calculating DVs:

- *Modeling Procedures for Demonstrating Compliance with the PM<sub>2.5</sub> NAAQS* [4]
- *Guidance for PM<sub>2.5</sub> Permit Modeling* [5]

### **1-Hour NO<sub>2</sub> Guidance**

The EPA has issued three documents regarding the demonstration of NO<sub>2</sub> NAAQS compliance:

- *Applicability of Appendix W Modeling Guidance for the 1-hour NO<sub>2</sub> NAAQS* [6]
- *Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO<sub>2</sub> NAAQS* [7]
- *Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO<sub>2</sub> National Ambient Air Quality Standard* [8]

These documents discuss using background concentrations to demonstrate NO<sub>2</sub> NAAQS compliance based on either a “First Tier” or “Second Tier” approach. 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 one year of site-specific modeled data for assessing 1-hour NO<sub>2</sub> 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<sub>2</sub> NAAQS compliance. Additional detail is provided in the EPA guidance documentation if a more refined approach is required to demonstrate NO<sub>2</sub> NAAQS compliance.

### **1-Hour SO<sub>2</sub> Guidance**

To demonstrate SO<sub>2</sub> NAAQS compliance, the EPA recommends a “First Tier” approach using the highest monitored background concentration and adding that to the modeled DV. A less conservative “Refined First Tier” approach based upon temporally varying background concentrations is also possible but would require interagency coordination. Refer to the following the EPA guidance for using background concentrations for calculating DVs for SO<sub>2</sub> NAAQS compliance:

- *Applicability of Appendix W Modeling Guidance for the 1-hour SO<sub>2</sub> 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](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<sub>2.5</sub> NAAQS, March 23, 2010, Office of Air Quality Planning and Standards, <https://www.epa.gov/sites/default/files/2015-07/documents/pm25memo.pdf>
5. Environmental Protection Agency (EPA), Guidance for PM<sub>2.5</sub> Permit Modeling, EPA-454/B-14-001, May 2014, [https://www.epa.gov/sites/default/files/2020-09/documents/guidance\\_for\\_pm25\\_permit\\_modeling.pdf](https://www.epa.gov/sites/default/files/2020-09/documents/guidance_for_pm25_permit_modeling.pdf)
6. Environmental Protection Agency (EPA), Memo: Applicability of Appendix W Modeling Guidance for the 1-hour NO<sub>2</sub> National Ambient Air Quality Standard, June 28, 2010, Office of Air Quality Planning and Standards, [https://www.epa.gov/sites/default/files/2020-10/documents/clarificationmemo\\_appendixw\\_hourly-no2-naaqs\\_final\\_06-28-2010.pdf](https://www.epa.gov/sites/default/files/2020-10/documents/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 1-hour NO<sub>2</sub> 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](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<sub>2</sub> National Ambient Air Quality Standard, September 30, 2014, Office of Air Quality Planning and Standards, [https://www.epa.gov/sites/default/files/2020-10/documents/no2\\_clarification\\_memo-20140930.pdf](https://www.epa.gov/sites/default/files/2020-10/documents/no2_clarification_memo-20140930.pdf)
9. Environmental Protection Agency (EPA), Memo: Applicability of Appendix W Modeling Guidance for the 1-hour SO<sub>2</sub> National Ambient Air Quality Standard, August 23, 2010, Office of Air Quality Planning and Standards, [https://www.epa.gov/sites/default/files/2020-10/documents/clarificationmemo\\_appendixw\\_hourly-so2-naaqs\\_final\\_08-23-2010.pdf](https://www.epa.gov/sites/default/files/2020-10/documents/clarificationmemo_appendixw_hourly-so2-naaqs_final_08-23-2010.pdf)