Appendix M

How to Post-Process Offsite Worker Concentrations using the Hourly Raw Results from AERMOD

This appendix describes how to calculate refined offsite worker concentrations using the hourly raw results from the AERMOD air dispersion model. In some cases, a better representation of what the offsite worker breathes during their work shift is needed for the health risk analysis. To obtain a better representation, the hourly raw results contain enough information to allow the risk assessor to evaluate the concentrations that occurs during the offsite worker's shift. However, since the hourly raw results include all the concentrations for every hour of meteorological data at each receptor for each source in the air dispersion analysis, the results must be filtered and processed to obtain the refined offsite worker concentrations. The basic steps include: 1) determining the averaging periods needed for the offsite worker analysis; 2) outputting the hourly raw results from the AERMOD air dispersion model; 3) extracting the hourly concentrations based on when the receptor is present; and 4) identifying or calculating the required concentration. The calculation methods described in this appendix can be used for assessing acute, 8-hour non-cancer chronic, and inhalation cancer health impacts.

M.1 Determine the Averaging Periods Required for the Offsite Worker Health Risk Analysis

Before any refined offsite worker concentrations can be calculated, the first step is to determine which type of refined concentrations or averaging periods are needed for the health risk analysis. The refined averaging periods needed for the analysis are based on the pollutant-specific health values emitted by the source or sources. Specifically, refined offsite worker concentrations can only be used for pollutants that have inhalation cancer potency factors, 8-hour RELs, and/or acute RELs. This section describes the refined averaging periods required for assessing acute RELs, 8-hour RELs, and inhalation cancer potency factors.

M.1.1 Averaging Period Required for Acute RELs

The maximum 1-hour concentration is typically required for the acute health hazard index calculation. AERMOD can determine and output the maximum 1-hour concentration at each receptor location for each source in the air dispersion analysis. However, if more refined concentrations for the offsite worker are needed, the maximum1-hour concentration that occurs during the offsite worker's shift may be used.

This type of refinement can be processed using the hourly raw results from the air dispersion analysis.

If there are multiple sources in the analysis, an additional refinement step is to examine the coincident acute health impacts at each receptor from all sources at each hour during the offsite worker's shift and identify the total maximum acute health impacts from all sources. For example, if there are two sources that emit a single pollutant for ten hours per day and the offsite worker's shift is from hour three to hour seven, the risk assessor may evaluate the total acute risk from all sources during the offsite worker's shift. Assuming the acute REL is 50 µg/m^3, the highest acute health impact occurs at hour three with a Health Hazard Index of 0.3 (see Table M.1). This approach is also known as a refined acute analysis.

Table M.1. Example of a Refined Acute Calculation

Hour	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Source 1 Concentration (µg/m^3)	5	7	8	0	9	11	5	1	12	3
Source 2 Concentration(µg/m^3)	4	6	7	0	2	1	3	4	5	2
Total Acute Health Hazard Index from All Sources	0.18	0.26	**0.3**	0	0.22	0.24	0.16	0.1	0.34	0.1

M.1.2 Averaging Period Required for Inhalation Cancer Potency Values

The period average is typically required for cancer risk assessments. AERMOD calculates this average by summing all the hourly concentrations and dividing it by the number of processed hours over the entire time period of the air dispersion analysis. However, the period averages calculated from AERMOD typically represent exposures for receptors (i.e., residential receptors) that are present 24 hours a day and seven days per week. For the offsite worker, the period average should represent what the worker breathes during their work shift when assessing the cancer inhalation pathway.

To estimate the offsite worker's concentration, there are two approaches. The simple approach is to obtain the period average concentration as calculated by AERMOD and approximate the worker's inhalation exposure using an adjustment factor (See Chapter 2.8.1.1. for more information). For a more representative concentration, the second approach is to calculate a refined period average using the hourly raw results from the air dispersion analysis. This refined period average should reflect only the concentrations that occur during the offsite worker's shift. It is calculated by summing all of the hourly concentrations that occurs during the offsite worker's shift and dividing it by the number of hours that occurs during the offsite worker's shift. The equation for calculating the refined offsite worker concentration is shown in Section 4.3.

M.1.3 Averaging Period Required for 8-Hour RELs

For 8-hour noncancer health impacts, we evaluate if the worker is exposed to a daily (e.g., 8-hour) average concentration that exceeds the 8-hour REL. The daily average concentration is intended to represent the long term average concentration the worker is breathing during their work shift. The long-term 8-hour daily average concentration is required for 8-hour health hazard index calculations. Specifically, this concentration represents the long-term average of repeated 8-hour daily averages that occur when the source's emission schedule and offsite worker's schedule overlap. For example, the 8-hour averages are first calculated for each day in the air dispersion analysis. The 8-hour averages should represent the eight hour sequential concentration for when the source's emission schedule and offsite worker's schedule overlap. All the 8-hour averages are then averaged over the entire time period of the air dispersion analysis.

There are two approaches for calculating the average 8-hour daily concentration. The simple approach is to obtain the long-term concentration (i.e., period average) as calculated by AERMOD and approximate the average 8-hour daily concentration using an adjustment factor (See Chapter 2.8.1.2 for more information). For a more representative concentration, the second approach is to calculate the offsite worker concentration using the hourly raw results from the air dispersion analysis.

Please note that although the duration of work shifts or period of overlap with the source's emission schedule can vary from eight hours, the calculated long-term daily average concentrations can still be applied to the 8-hour RELs. However, the risk assessor may wish to calculate the 8-hour hazard index using the adjustment factor approach as a screening assessment before proceeding with the post-processing approach. Based on the results of the screening assessment, the risk assessor can contact OEHHA for assistance in determining whether further evaluation may be necessary.

M.2 Output the Hourly Raw Results from AERMOD

The hourly raw results from the air dispersion analysis are needed to calculate the refined offsite worker concentrations as described above. AERMOD can output the hourly raw results to a file for post-processing. In order to output a file suitable for post-processing, the AERMOD input file must be modified. The AERMOD input file contains the modeling options, source location and parameter data, receptor locations, meteorological data file specifications, and output options. It is organized into five main sections that include the Control (CO), Source (SO), Receptor (RE), Meteorology (ME), and Output (OU) pathways (U.S. EPA, 2004). This section describes how to modify the pathways in the AERMOD input file to allow the hourly raw results to be saved to a file.

M.2.1 Modify the Control (CO) Pathway to Identify Calm and Missing Hours

By default, AERMOD disregards calm and missing hours when calculating the long-term and short-term averages. When calculating the refined offsite worker concentrations, the calm and missing hours must also be disregarded. However, the hourly raw results from AERMOD do not identify which hours are calm or missing. Since this is the case, an additional file from AERMOD must also be saved in order to post-process the hourly raw results correctly. The AERMOD Detailed Error Listing File will report all calm and missing hours from the air dispersion analysis. The syntax for creating a Detailed Error Listing File in the CO pathway is shown below. This modification in the CO pathway will create a file which will be used to assist with calculating the refined offsite worker concentrations. This process is described in the subsequent sections of this appendix.

Syntax for Creating the Detailed Error Listing File

CO ERRORFIL [Filename]

M.2.2 Modify the Source (SO) Pathway if Unit Emission Rates are used

In an air dispersion analysis, it is typical to use non-substance specific unit emission rates (e.g., 1 g/s) for evaluating multiple pollutants. This precludes modelers from having to run the air dispersion model for each individual pollutant that is emitted from a source. Unit emission rates allow the air dispersion modeling results to be expressed as dilution factors in $(\mu g/m^3)/(g/s)$. When these dilution factors are combined with the pollutant specific emission rate (g/s), it will yield the ground level concentrations ($\mu g/m^3$) for each pollutant in the analysis. When there are multiple sources in the air dispersion analysis and unit emission rates are used, the individual source contributions must be provided in the modeling results so the ground level concentrations can be correctly scaled for each pollutant. To do this, the air dispersion input file must be modified to create individual source groups for each source. The example below shows how individual source groups for two sources (S001 and S002) are specified in the SO pathway of an AERMOD input file. This modification in the SO pathway will allow the individual source contributions to be saved in the hourly raw results.

```
SO STARTING

**S001 and S002 location and source parameters are not shown.**

SRCGROUP SRCGP1 S001

SRCGROUP SRCGP2 S002

SO FINSHED
```

This parameter identifies the sources tied to the source group. Use only one source ID per source group.

This section specifies the name of your source group. The source group name is what is specified when you output the required concentrations files.

Please note that a separate input file is needed for evaluating acute health impacts when unit emission rates are used and the source has a variable emission schedule (e.g., emissions vary by hour-of-day and day-of-week). Acute health impacts are based on maximum hourly emissions whereas cancer and chronic health impacts are based on average hourly emissions. To correctly simulate unit emissions for the acute impacts, a duplicate source with a variable emission rate of "on" (1) or "off" (0) should be used so the maximum hourly inventory is correctly calculated separately from the emission factors placed in the annual file. The example below shows how the variable emission rates should be modified. Alternatively, a source can be duplicated in the same input file instead of rerunning the source using a separate input file.

First Run with Unmodified Emission Rate Factors for Long-Term

```
EMISFACT S002  HROFDY   0.000   0.000   0.000   0.000   0.000
         S002  HROFDY   0.000   2.667   2.667   2.667   2.667
         S002  HROFDY   2.667   2.667   1.333   1.333   1.333
         S002  HROFDY   1.333   1.333   1.333   0.000   0.000
         S002  HROFDY   0.000   0.000   0.000   0.000
```

Second Run with Modified Emission Rates Factors for Acute

```
EMISFACT S002  HROFDY   0.000   0.000   0.000   0.000   0.000
         S002  HROFDY   0.000   1.000   1.000   1.000   1.000
         S002  HROFDY   1.000   1.000   1.000   1.000   1.000
         S002  HROFDY   1.000   1.000   1.000   0.000   0.000
         S002  HROFDY   0.000   0.000   0.000   0.000
```

M.2.3 Modify the Receptor (RE) Pathway to Reduce the Processing Time

AERMOD is capable of outputting the hourly raw results from the air dispersion analysis. However, without taking appropriate precautions, outputting the hourly raw results can produce extremely large file sizes especially when evaluating multiple years of meteorological data, a large number of receptors, and short-term averaging periods (e.g., 1-hour). To minimize the amount of processing time and hard disk space, it is recommended to use only a single discrete receptor representing the off-site worker location. The proper syntax for specifying a discrete receptor is shown below.

Sample Syntax for Creating a Single Discrete Receptor

```
RE DISCCART XcoordYcoord (ZelevZhill) (Zflag)
```

M.2.4 Modify the Output (OU) Pathway to Output the Hourly Raw Results

To create a file containing the hourly raw results, modify the OU pathway to include the POSTFILE keyword and parameters. The sample below shows the syntax for outputting the hourly raw results for a single source. The POSTFILE will list in order the concentration for each receptor and for each hour of meteorological data regardless of the source's emission schedule. Use Table M.2 to help construct the proper syntax for the POSTFILE option. This step must be repeated for each source in the analysis which will result in additional files.

Please note that if the data are outputted as binary file (UNFORM), a separate computer program will be needed to read and parse the data.

Sample Syntax for Outputting the Hourly Concentrations for a Single Source

```
OU POSTFILE 1 SRCGP1PLOT PSTS001.TXT
```

Table M.2. Descriptions of the POSTFILE Parameters

Keyword	Parameters	
POSTFILE	AveperGrpid Format Filnam (Funit)	
where:	Aveper	Specifies averaging period to be output to file. Set this value to 1 to output 1-hour raw results.
	Grpid	Specifies source group to be output to file. If there are multiple sources, you will need to repeat the POSTFILE option for each source. You can combine the different outputs to a single file using the Funit parameter.
	Format	Specifies format of file, either UNFORM for binary files or PLOT for formatted files. Unformatted files offer a smaller file size; however, this file requires programming expertise in order to view and parse the data. Selecting the PLOT option will allow you to view the file in any text editor.
	Filnam	Specifies filename for output file
	Funit (optional)	The file unit is an optional parameter. If the filename and the file unit number are the same, the results for different source groups can be combined into a single file.

M.3 Extract the Hourly Concentrations when the Offsite Worker is Present

To calculate the refined offsite worker concentrations, it is necessary to extract the hourly concentrations based on the offsite worker's schedule. This section provides information on how to extract the hourly concentrations for the offsite worker including the calm and missing hours that may occur during the offsite worker's shift.

At this point, it is recommended the hourly raw results be imported into a spreadsheet or database to assist with the extraction process. Spreadsheets and database contain preprogrammed functions to assist with deciphering data. **Use the information in Section M.3.1 as a guide to help import the hourly raw results into a database or spreadsheet.**

M.3.1 Description of the POSTFILE File Format

AERMOD was created using FORTRAN, a type of programming language. When the AERMOD output files are created, it is based on a specified FORTRAN format. The variables provided on each data record in the POSTFILE include the X and Y coordinates of the receptor location, the concentration value for that location, receptor terrain elevation, hill height scale, flagpole receptor height, the averaging period, the source group ID, and the date for the end of the averaging period (in the form of YYMMDDHH) (U.S. EPA, 2004). Table M.3 shows the equivalent data types based on the POSTFILE format. The POSTFILE will list in order the concentration for each receptor and for each hour of meteorological data regardless of the source's emission schedule (see Figure M.3.1). Use the information in this section as a guide to help import the hourly raw results into a database or spreadsheet.

Table M.3. POSTFILE Variables and Equivalent Data Types

Column Name	Fortran Format	Equivalent Data Type
X	F13.5	Number/Double Precision
Y	F13.5	Number/Double Precision
AVERAGE_CONC	F13.5	Number/Double Precision
ZELEV	F8.2	Number/Double Precision
ZHILL	F8.2	Number/Double Precision
ZFLAG	F8.2	Number/Double Precision
AVE	A6	6-Character String/Text
GRP	A8	8-Character String/Text
NUM_HRS OR DATE	I8.8	8-Character String/Text
NET_ID	A8	8-Character String/Text

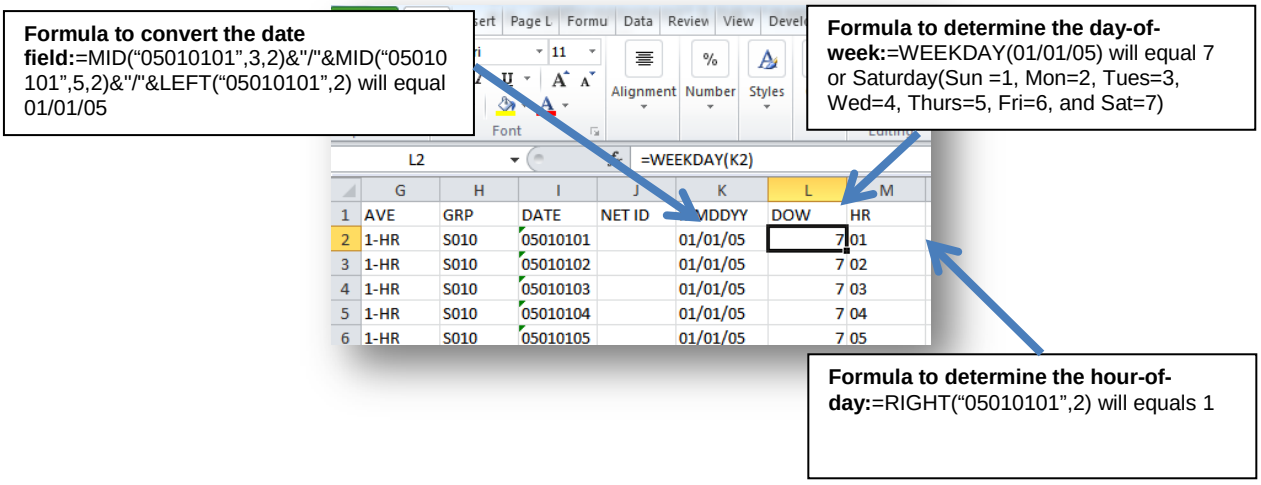
Figure M.3.1. Sample of an AERMOD POSTFILE

```
AERMOD (09292): LARGE PS                                                    08/24/10
MODELING OPTIONS USED:                                                      07:39:24
NonDFAULT CONC                          FLAT          FLGPOL
        POST/PLOT FILE OF CONCURRENT  1-HR VALUES FOR SOURCE GROUP: S010
        FOR A TOTAL OF     1 RECEPTORS.
        FORMAT: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)
       X             Y        AVERAGE CONC    ZELEV    ZHILL    ZFLAG    AVE     GRP      DATE       NET ID
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010101
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010102
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010103
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010104
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010105
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010106
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010107
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010108
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010109
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010110
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010111
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010112
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010113
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010114
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010115
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010116
 100.00000     0.00000     0.00000    10.00    10.00     1.20    1-HR    S010    05010117
```

M.3.2 Determine the Day-of-Week and Hour-of-Day

In order to extract only the hourly concentrations that occur when an offsite worker is present, the risk assessor must first determine the day-of-week and hour-of-day for each hourly record using the date field. Since the date outputted by AERMOD cannot be directly interpreted by the day-of-week function in a database or spreadsheet, the date must be first converted. For example, the date field can be first converted using the LEFT and MID functions in Microsoft Excel (See Column K in Figure M.3.2). After which, the WEEKDAY function in Microsoft Excel can be used to determine the day-of-week (See Column L in Figure M.3.2). The hour-of-day can be extracted using the RIGHT function (See Column M in Figure M.3.2).

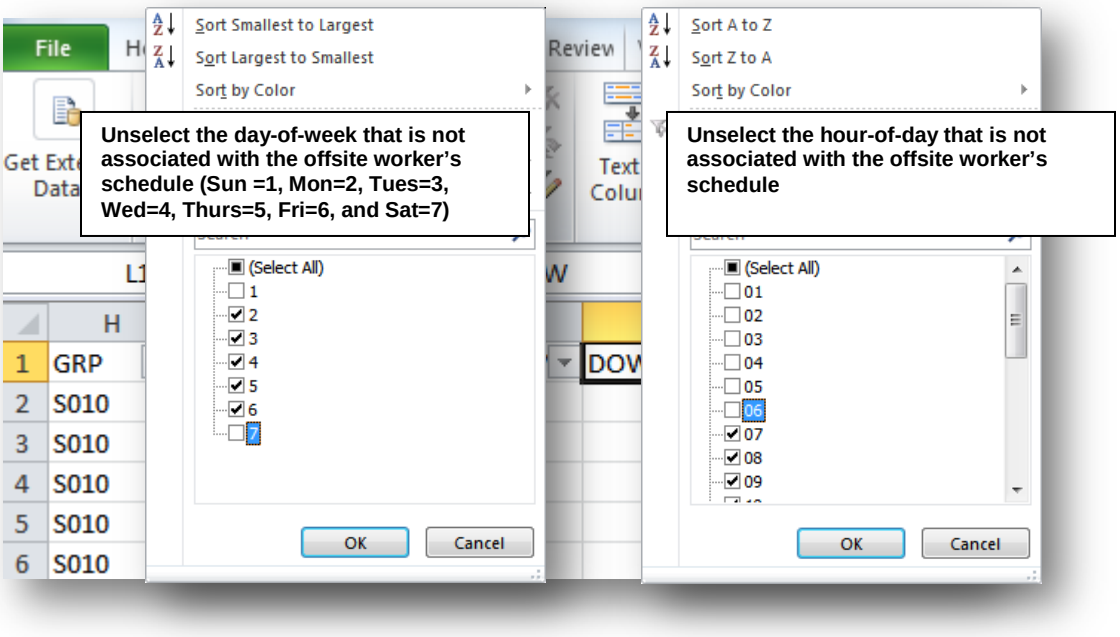
Figure M.3.2. How to Determine the Day-of-Week and Hour-of-Day in Microsoft Excel



M.3.3 Extract the Hourly Concentrations Based on the Offsite Worker's Schedule

After the day-of-week and hour-of-day have been determined, the concentrations can now be extracted or filtered. Based on the offsite worker's schedule, filter or query the hourly concentrations using a spreadsheet or database. For example, in Microsoft Excel, you can filter the data by selecting the data filter option (see Figure M.3.3). Then unselect the records that are not associated with the offsite worker's schedule using the day-of-week and hour-of-day fields that were created in previous section. If the data contains information for multiple receptors, filter the X and Y coordinates to get the concentrations that are specific to each receptor. The results from the filter will now only show hourly concentrations for times when the offsite worker is present.

Figure M.3.3. How to Filter the Data in Microsoft Excel



M.3.4 Count the Number of Calm and Missing Hours that Occur During the Offsite Worker's Schedule

If calm hour processing was used in the air dispersion analysis, then calm and missing hours must also be considered when post-processing the long-term and short-term averages for the offsite worker. To assist in this calculation, the Detailed Error Listing File that was created from the air dispersion analysis (Section 2.1) can be used to count the number of calm and missing hours that occurred during the worker's shift.

To identify the calm and missing hours, it is recommended to import the Detailed Error Listing File into a spreadsheet or database. Then follow the instructions from Sections 3.2 and 3.3 to determine the number of calm and missing hours that occur during the offsite worker's schedule. This information is needed to calculate the averaging periods for the offsite worker.

M.4 How to Identify or Calculate the Refined Concentrations for the Offsite Worker Analysis

Depending on which averaging periods are needed (as determined by Section 1.0), use Sections 4.1 through 4.3 below to identify or calculate refined concentrations for estimating the acute, 8-hour, and cancer health impacts. The equations are based on how the long-term and short-term averages are calculated in AERMOD. These equations also account for how calm and missing hours are handled by AERMOD (U.S. EPA, 2005). After calculating the appropriate averaging periods, the refined concentrations can be used to assess the health impacts for the offsite worker's inhalation pathway.

Please note that if unit emission rates were used in the air dispersion analysis, each averaging period calculated using the methods below must be combined with the pollutant specific emission rate (g/s) to yield the actual ground level concentrations (µg/m^3) for each pollutant in the analysis before the health impacts can be assessed.

M.4.1 How to Determine the Maximum 1-Hour Average for a Simple Acute Assessment

The maximum 1-hour average concentration represents the highest concentration that occurs during the offsite worker's schedule. To determine the maximum 1-hour average, sort the extracted hourly concentrations in descending order using a spreadsheet or a database. The maximum hourly concentration will be at the top of the list (Figure M.4.1). This process must be repeated at each receptor for all sources of interest.

Figure M.4.1. Identifying the Maximum 1-Hour Concentration

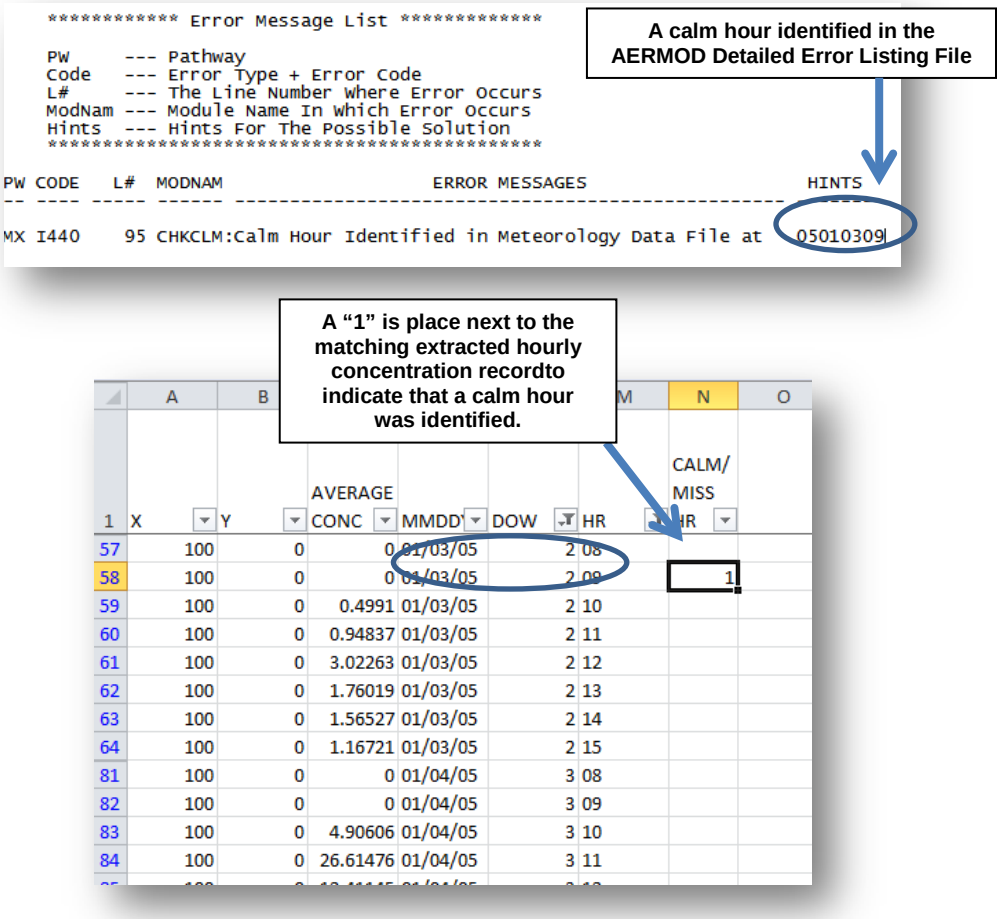
A	B	C	D	E	F	G	H	I	J	K	L
X	Y	AVERAGE CONC	ZELEV	ZHILL	ZFLAG	AVE	GRP	DATE	NET ID	MMDD	DOW
100	0	110.2656	10	10	1.2	1-HR	S010	05082610		08/26/05	
100	0	105.365	10	10	1.2	1-HR	S010	05082315		08/23/05	
100	0	105.1168	10	10	1.2	1-HR	S010	05080512		08/05/05	
100	0	103.7613	10	10	1.2	1-HR	S010	05071310		07/13/05	
100	0	103.6595	10	10	1.2	1-HR	S010	05082314		08/23/05	
100	0	103.6498	10	10	1.2	1-HR	S010	05071113		07/11/05	
100	0	103.2635	10	10	1.2	1-HR	S010	05082413		08/24/05	
100	0	103.0836	10	10	1.2	1-HR	S010	05012012		01/20/05	
100	0	102.8738	10	10	1.2	1-HR	S010	05052310		05/23/05	

M.4.2 How to Determine the Long-Term Average of 8-Hour Daily Concentrations for an 8-Hour Assessment

To calculate the long-term 8-hour daily average concentration, the 8-hour averages are first calculated for each day in the air dispersion analysis. All the 8-hour averages are then averaged over the entire time period of the air dispersion analysis. However, since the 8-hour daily average is considered a short-term average, the total number of valid hours (i.e., not calm or not missing) must be considered. The total number of valid hours should be 75% of the 8-hour average. If the total number of valid hours in an 8-hour average is less than six (6), the 8-hour total concentration should be divided by six (6) (U.S. EPA, 2005). The following steps below are an example that shows how the average of 8-hour daily concentration is calculated.

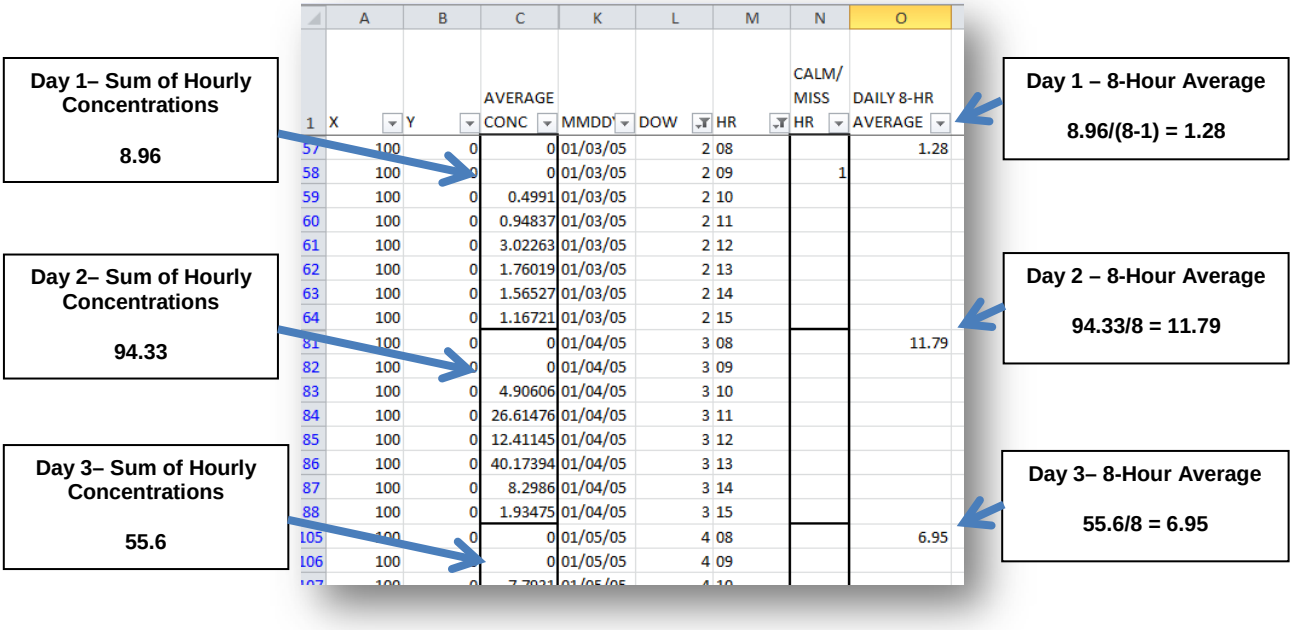
- Using the extracted hourly concentrations based on the steps from Section 3.0, identify any calm and missing hours with a “1”. To do this, use the Detailed Error Listing File that was created from the air dispersion analysis (See Section 2.1 for more information).The Detailed Error Listing File will list the calm and missing hours by date. Place a “1” where the dates match up with the extracted hourly concentrations (See Column N in Figure M.4.2.1). Please note that some of the columns are hidden in Figure M.4.2.1 for presentation purposes.

Figure M.4.2.1. Identify Calm and Missing Hours



- Then calculate the 8-hour average for each day throughout the file. The 8-hour average is the sum of the hourly concentrations in a day divided by eight (see Figure M.4.2.2). However, if there are any calm or missing hours in the time period, the sum of hourly concentrations should be divided by total number of valid hours. The total number of valid hours is eight minus the total number of calm and missing hours. If the total number of valid hours is less than six, then the sum of hourly concentrations should be divided by six.

Figure M.4.2.2. 8-Hour Daily Average Calculation



	A	B	C	K	L	M	N	O
1	X	Y	AVERAGE CONC	MMDD	DOW	HR	CALM/ MISS HR	DAILY 8-HR AVERAGE
57	100	0	0	01/03/05	2	08		1.28
58	100	0	0	01/03/05	2	09	1	
59	100	0	0.4991	01/03/05	2	10		
60	100	0	0.94837	01/03/05	2	11		
61	100	0	3.02263	01/03/05	2	12		
62	100	0	1.76019	01/03/05	2	13		
63	100	0	1.56527	01/03/05	2	14		
64	100	0	1.16721	01/03/05	2	15		
81	100	0	0	01/04/05	3	08		11.79
82	100	0	0	01/04/05	3	09		
83	100	0	4.90606	01/04/05	3	10		
84	100	0	26.61476	01/04/05	3	11		
85	100	0	12.41145	01/04/05	3	12		
86	100	0	40.17394	01/04/05	3	13		
87	100	0	8.2986	01/04/05	3	14		
88	100	0	1.93475	01/04/05	3	15		
105	100	0	0	01/05/05	4	08		6.95
106	100	0	0	01/05/05	4	09		

- Assuming that there were only three days in the entire time period of the air dispersion analysis, the average of 8-hour daily concentrations is (1.28 11.79 + 6.95) /3 = 6.78.

M.4.3 Equation for Calculating the Average Concentration for the Inhalation Cancer Pathway

Below is the equation for calculating the period average for the inhalation cancer pathway. This calculation must be repeated at each receptor for each source of interest.

$$C_{worker\_period\_average} = \frac{\sum C_{hourly}}{N_{total\_hrs} - N_{calm\_hrs} - N_{missing\_hrs}}$$

Where:

C_{hourly} = the concentration that occurs during the worker's shift. To obtain the sum of the hourly concentrations for the offsite worker, sum the extracted worker concentrations from Section 3.0.

N_{total_hrs} = the number of processed hours that occur during worker's shift. To obtain the number of processed hours, use the COUNT function to return the total number of extracted worker concentrations from Section 3.0.

N_{calm_hrs}= the number of calm hours that occur during the worker's shift. To obtain the number of calm and missing hours, use the COUNT function to return the total number of missing and calm hours from Section 3.0. Since the total will include missing hours, it is not necessary to repeat this step for the variable below.

$N_{missing\_hrs}$ = the number of missing hours that occur during worker's shift.

M.5 References

U.S. EPA (2004). User's Guide for the AMS/EPA Regulatory Model – AERMOD. EPA-454/B-03-001.U.S. Environmental Protection Agency, Research Triangle Park, NC.

U.S. EPA (2005). Guideline on Air Quality Models (Revised). 40 CFR 51, Appendix W.