

CORRESPONDENCE/MEMORANDUM

DATE: October 15, 2021

TO: Permit & Compliance Staff

FROM: Stationary Source Modeling Team

SUBJECT: Guidance on Background Concentrations¹

INTRODUCTION

To be consistent with current federal and state ambient air standards, the Air Management Program has prepared the following update to the background concentrations used in stationary source modeling in support of air permit issuance. The background concentrations listed in the following table are the values to be used for air dispersion modeling as of the date of this memorandum.

Wisconsin Background Concentrations (All Concentrations in $\mu\text{g}/\text{m}^3$)			
Pollutant	Time Period	High Value	Low Value
PM _{2.5}	24 Hour	20.8	18.0
	Annual	8.00	6.50
PM ₁₀	24 Hour	33.1	27.0
Pb	Quarterly	0.02	0.01
SO ₂	All Applicable	HROFDY & MONTH (Download)	HROFDY & MONTH (Download)
NO ₂	All Applicable	HROFDY & MONTH (Download)	HROFDY & MONTH (Download)
CO	1 Hour	1,196.0	494.7
	8 Hour	916.8	420.2

¹ This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

IMPLEMENTATION

Beginning October 31, 2021, permits where a modeling analysis is performed will be evaluated with the background concentrations noted in this memo for all applicable time periods. Permits already in public comment on October 31, 2021, or waiting to be issued, can be re-evaluated for modeling on a case-by-case basis to determine if the updated background concentrations can be applied to determine a new emission limit. Re-evaluating the modeling analysis potentially could add time to the permit process, depending on the change to the proposed limit.

The regulatory dispersion model AERMOD allows for the inclusion of background concentrations using the BACKGRND keyword on the SO (Source) pathway. Background concentrations can be specified for different time periods, such as hour of day, day of week, and month. The SO₂ and NO₂ background concentrations can be entered using the MHRDOW background flag parameter using the same hour of day and month values for weekdays, Saturdays, and Sundays. Files are available on the Wisconsin DNR web site at the dispersion modeling page: {<https://dnr.wisconsin.gov/topic/AirPermits/Modeling.html>}

In the AERMOD input file, the BACKUNIT keyword should also be used to indicate values are in µg/m³, rather than the default value of ppb, and the BACKGRND (or BACKGROUND) parameter included in each source group, as well as the case of source group ALL.

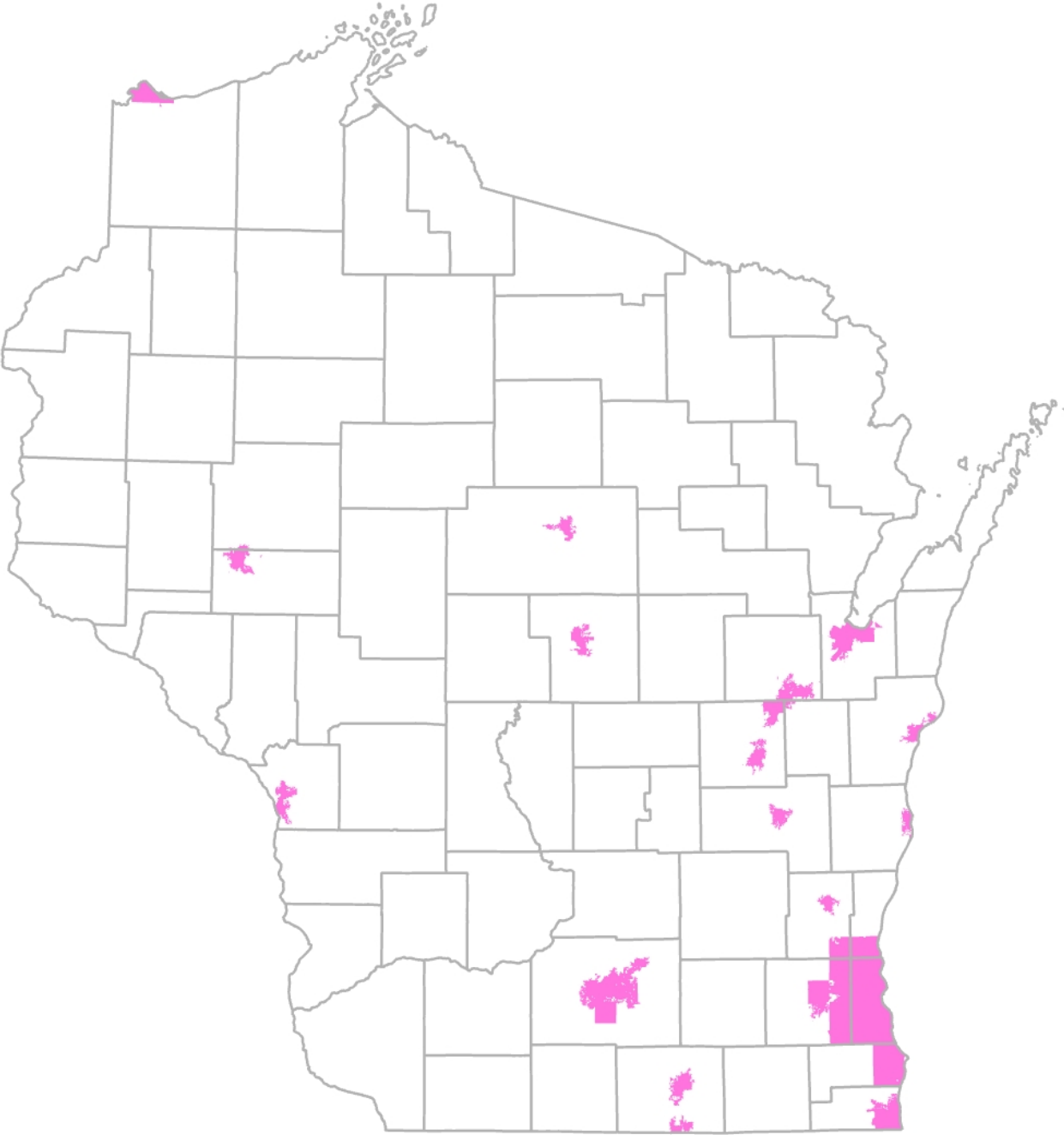
METHODOLOGY

Geographic Areas

To determine the proper population threshold separating higher background concentrations areas from lower, all cities and villages in Wisconsin were examined using the Vintage 2020 U.S. Census data. Cities and villages with populations of 25,000 residents were identified as high background areas. Areas with lower population generally have less industry, fewer residential emissions, and less traffic, so higher background concentrations would not be appropriate.

Many of the larger cities in Wisconsin have neighboring suburbs that, when combined, are considered one metropolitan area. Legally and administratively, these cities and villages are separate entities but for the purposes of background concentrations these areas are considered as one contiguous region. The year 2020 U.S. Census data was again consulted, and a list was created of all cities and villages immediately adjacent to a larger city or village (i.e. one with population of 25 000 people or more). For the purposes of this document, if the population density of the neighboring city or village is more than half the population density of the main city or village, then it is considered a portion of the main city or village. Also, if the larger city or village surrounds another city or village, the surrounded entity was considered a portion of the main city or village. This total area is then assigned the higher background concentration. Using this method, the following map and table were developed to show in what areas the higher background concentration are to be used and in what areas the lower concentration are to be used. Facilities located in the pink areas on the graphic should use the high background, while facilities in the remainder of the state should use the low background.

Wisconsin High Background Concentration Areas



Cities and villages can change their boundaries (e.g. through annexation), so the graphic is not an official indicator of the proper background concentrations to use. The following table lists all the areas where the higher background concentrations must be used. If a given area expands due to annexation or incorporation, the higher background concentration values would apply to the additional (i.e. annexed, incorporated) area.

Wisconsin High Background Concentration Areas	
Main City	Additional Incorporated (City or Village) Areas
Superior	-
Eau Claire	-
Wausau	Schofield
Stevens Point	Plover, Whiting
La Crosse	Onalaska
Green Bay	Ashwaubenon, Allouez, De Pere
Appleton	Menasha, Neenah, Little Chute, Kimberly, Combined Locks, Kaukauna, Fox Crossing
Manitowoc	Two Rivers
Oshkosh	-
Fond du Lac	North Fond du Lac
Sheboygan	-
West Bend	-
Madison	Middleton, Shorewood Hills, McFarland, Maple Bluff, Sun Prairie, Monona, Fitchburg
Janesville	-
Beloit	-
Kenosha	Pleasant Prairie
Racine	Caledonia, Mount Pleasant, Sturtevant
Milwaukee	St. Francis, Cudahy, South Milwaukee, Oak Creek, Franklin, Greenfield, Greendale, Hales Corners, West Allis, West Milwaukee, Wauwatosa, Shorewood, Glendale, Whitefish Bay, Brown Deer, Fox Point, River Hills, Bayside, Menomonee Falls, Butler, Lannon, Brookfield, Elm Grove, New Berlin, Muskego, Germantown, Mequon, Theinsville, Pewaukee (city & village), Waukesha

Notes

- The designated areas are based on the corporate boundaries of the city or village, not the ZIP code; refer to each county’s land parcel viewer available at the specific counties’ web site
- If the emission sources of a facility are located within the corporate boundaries of an area listed in the table, the high background concentrations should be used
- If emission sources for a modeling analysis lay both inside and outside of an area listed in the table, or the corporate boundaries are uncertain, the high background concentrations should be used

Background Concentration Value Determination

Three years of monitoring data (2018-2020) was obtained for PM₁₀, PM_{2.5}, SO₂, NO₂, and CO, and the values categorized by the location of the monitor. To increase the number of values, any additional sensor techniques (POC Codes) were included so long as 70% of the data in a year was available. Values for CO represent the second highest in each year, and the background value is the three-year average of the second highest values. Values for PM₁₀ and 24-hr PM_{2.5} are the 98th percentile value from each year, and the background value is the average of all sensors and all years within the high or low geographic area. Annual PM_{2.5} background is the average of annual values for all sensors and years.

For lead (Pb), WDNR monitoring is source-specific and the filer-based method makes it difficult to assess wind direction-specific concentrations. Qualitative review of special study and tribal lead monitor data collected outside of urban areas show concentrations less than 0.01 µg/m³. After discussion with WDNR air monitoring staff, the low background value was assigned as 0.01 µg/m³. To account for distant and nearby emission sources if lead not explicitly modeled, the high lead background value was doubled to 0.02 µg/m³.

Temporally varying background monitored concentrations were developed for NO₂ and SO₂ following the methodology presented in USEPA's August 2016 *SO₂ NAAQS Designations Modeling Technical Assistance Document*, and USEPA's March 1, 2011 memorandum, *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO₂ Ambient Air Quality Standard*. The first highest hour-of-day and month value was used.

The high background concentration for both SO₂ and NO₂ is derived from the WDNR Southeast Region monitor in the City of Milwaukee. There is one large facility located 3.5 kilometers south-southwest of the monitor, so hourly meteorological data was used to remove the influence of that facility from the monitor data distribution. Prior to summarization, monitored concentrations were removed from any hour where the wind speed was calm or missing, and where the average wind direction was within +/- 15 degrees of the radial connecting the monitor location and the facility.

Low background concentration for SO₂ is derived from the 2018-2020 Horicon monitor in Dodge County. Low background concentration for NO₂ is derived by combining hourly data from the two rural monitor locations, one in Van Buren County, IA and another in Missaukee County, MI. To produce an unbiased estimate of low background, prior to summarization, the average value from the two locations was selected for each hour.