

An official website of the United States government.

[Close](#)

We've made some changes to EPA.gov. If the information you are looking for is not here, you may be able to find it on the [EPA Web Archive](#) or the [January 19, 2017 Web Snapshot](#).



Air Quality Dispersion Modeling - Preferred and Recommended Models

These refined dispersion models are listed in [Appendix W \(PDF\)](#) (45 pp, 803 K, [About PDF](#)) and are required to be used for State Implementation Plan (SIP) revisions for existing sources and for New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs. The models in this section include the following:

AERMOD Modeling System - A steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

CAL3QHC/CAL3QHCR - CALINE3 based CO model with queuing and hot spot calculations and with a traffic model to calculate delays and queues that occur at signalized intersections.

CTDMPLUS - A refined point source gaussian air quality model for use in all stability conditions for complex terrain.

OCD - A straight line Gaussian model developed to determine the impact of offshore emissions from point, area or line sources on the air quality of coastal regions.

AERMOD Modeling System

The American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) was formed to introduce state-of-the-art modeling concepts into the EPA's air quality models. Through AERMIC, a modeling system, AERMOD, was introduced that incorporated air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

There are two input data processors that are regulatory components of the AERMOD modeling system: [AERMET](#), a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and [AERMAP](#), a terrain data preprocessor that incorporates complex terrain using USGS Digital Elevation Data. Other non-regulatory components of this system include: [AERSCREEN](#), a screening version of AERMOD; [AERSURFACE](#), a surface characteristics preprocessor, and [BPIP PRIM](#), a multi-building dimensions program incorporating the GEP technical procedures for PRIME applications.

At this time, AERMOD does not calculate design values for the lead NAAQS (rolling 3-month averages). A post-processing tool, [LEADPOST \(ZIP\) \(65 M\)](#), is available to calculate design values from monthly AERMOD output. This tool calculates and outputs the rolling cumulative (all sources) 3-month average concentration at each modeled receptor with source group contributions and the maximum cumulative (all sources) rolling 3-month average concentration by receptor.

Below is the model code and documentation for AERMOD Version 19191. The model code and supporting documents are not static but evolve to accommodate the best available science. Please check this website often for updates to model code and associated documents. As of December 9, 2006, AERMOD is fully promulgated as a replacement to ISC3, in accordance with [Appendix W \(PDF\)](#).

AERMOD Modeling System Code and Documentation
AERMOD Implementation Guide
AERMOD Implementation Guide (PDF) (39 pp, 335 K, 2019) - Provides information on the recommended use of AERMOD for particular applications and is an evolving document.
AERMOD Modeling System Development
Modeling System Development Website and White Papers
Model Code
Executable (v19191) (ZIP) (1.4 M, 2019) - 64-bit Operating Systems Executable (v19191) (ZIP) (1.2 M, 2019) - 32-bit Operating Systems Source Code (v19191) (ZIP) (535 K, 2019)
Model Documentation

AERMOD Modeling System Code and Documentation

[AERMOD Quick Reference Guide \(PDF\)](#) (6 pp, 55 K, 2019)

[User's Guide \(PDF\)](#) (321 pp, 1.6 M, 2019)

[Model Change Bulletin #14 - Version Date 19191 \(PDF\)](#)

(5 pp, 178 K, 2019)

[Model Change Bulletin #13 - Version Date 18081 \(PDF\)](#)

(4 pp, 127 K, 2018)

[Model Change Bulletin #12 - Version Date 16216 \(PDF\)](#)

(2 pp, 167 K, 2016)

[Model Change Bulletin #11 - Version Date 15181 \(PDF\)](#)

(3 pp, 43 K, 2015)

[Model Change Bulletin #10 - Version Date 14134 \(PDF\)](#)

(6 pp, 37 K, 2014)

[Model Change Bulletin #9 - Version Date 13350 \(TXT\)](#) (9 K, 2013)

[Model Change Bulletin #8 - Version Date 12345 \(TXT\)](#) (9 K, 2012)

[Model Change Bulletin #7 - Version Date 12060 \(TXT\)](#) (6 K, 2012)

[Model Change Bulletin #6 - Version Date 11353 \(TXT\)](#) (3 K, 2011)

[Model Change Bulletin #5 - Version Date 11103 \(TXT\)](#) (3 K, 2011)

[Model Change Bulletin #4 - Version Date 11059 \(TXT\)](#) (13 K, 2011)

[Model Change Bulletin #3 - Version Date 09292 \(TXT\)](#) (3 K, 2009)

[Model Change Bulletin #2 - Version Date 07026 \(TXT\)](#) (4 K, 2007)

[Model Change Bulletin #1 - Version Date 06341 \(TXT\)](#) (10 K, 2006)

[Model Formulation and Evaluation Document](#)

(PDF) (177 pp, 3.8 M, 2019)

Test Cases

[AERMET-AERMOD Test Comparisons \(XLSX\)](#) (984 K, 2019)

[AERMOD Test Cases \(ZIP\)](#) (290.8 M, 2019)

Installation Guide (Sample Run)

AERMOD Modeling System Code and Documentation

[Read Me \(TXT\)](#) (1 K, 2014) - please read this file first

[Sample Run Instructions \(PDF\)](#) (11 pp, 464 K) - detailed installation and execution instructions

[Sample Run \(ZIP\)](#) (1.2 M) - sample test case

[AERPLOT Sample Run Instructions \(PDF\)](#) (4 pp, 190 K) - detailed installation and execution instructions

[AERPLOT Sample Run \(ZIP\)](#) (4.3 M) - sample test for AERPLOT

Model Supporting Documents

AERMOD Modeling System Code and Documentation

[Model Evaluation Paper \(PDF\)](#). (41 pp, 1 M, 2005)

[Bulk Richardson Number Evaluation Report](#)

(PDF). (34 pp, 329 K, 2004)

[Comparison of Regulatory Design Concentrations: AERMOD vs ISCST3,](#)

[CTDMPLUS, ISC-PRIME \(PDF\)](#). (89 pp, 31 K, 2003)

[Development and Evaluation of the PRIME Plume Rise and Building](#)

[Downwash Model \(PDF\)](#). (5 pp, 31 K, 1998)

[Project PRIME: Evaluation of Building Downwash Models Using Field and](#)

[Wind Tunnel Data \(PDF\)](#). (44 pp, 18 K, 1998)

[Development and Evaluation of the PRIME Plume Rise and Building](#)

[Downwash Model \(PDF\)](#). (34 pp, 588 K, 1999)

[Evaluation of Bias in AERMOD-PVMRM](#)

(PDF). (33 pp, 236 K, 2005)

[PVMRM and OLM Sensitivity Analysis \(PDF\)](#). (67 pp, 522 K, 2004)

[Ambient Ratio Method Version 2 \(ARM2\) Development and Evaluation](#)

[Report \(PDF\)](#). (67 pp, 2 M, 2004)

[Guidance on R-LINE Additions to AERMOD for Refined Transportation](#)

[Project Analyses](#)

[AERMOD Deposition Science Document](#)

(PDF). (95 pp, 196 K, 2013)

[AERMOD Deposition Parameterizations Document \(ZIP\)](#). (338 K)

[Draft Peer Review Document \(ZIP\)](#) (797 K) - For the AERMOD

Deposition Parameterizations Document (above)

[Technical Support Document \(TSD\) for AERMOD/BLP Development and](#)

[Testing](#) (43 pp, 1.0 M, 2016)

[Technical support document \(TSD\) for NO₂-related AERMOD](#)

[modifications](#) (32 pp, 1.6 M, 2016)

Model Evaluation Databases

AERMOD Modeling System Code and Documentation

README (TXT) (1 K) - Document that explains the databases below that contain input and output data for the model evaluation

AGA (ZIP) (2 M) - Input/output data for AGA: Flat, Rural, Downwash, Independent

Alaska (ZIP) (661 K) - Input/output data for Alaska: Flat, Rural Downwash, Developmental

Baldwin (ZIP) (4.5 M) - Input/output data for Baldwin: Flat, Rural, Non-downwash, Independent

Bowline (ZIP) (2 M) - Input/output data for Bowline: Flat, Rural, Downwash, Developmental/Independent

Clifty Creek (ZIP) (3.5 M) - Input/output data for Clifty Creek: Flat, Rural, Non-downwash, Independent

DAEC (ZIP) (1 M) - Input/output data for DAEC: Flat, Rural, Downwash, Developmental

EOCR (ZIP) (4 M) - Input/output data for EOCR: Flat, Rural, Downwash, Independent

Indianapolis (ZIP) (1 M) - Input/output data for Indianapolis: Flat, Urban, Non-downwash, Developmental

Kincaid SF6 (ZIP) (3 M) - Input/output data for Kincaid SF6: Flat, Rural, Non-downwash, Developmental

Kincaid SO2 (ZIP) (5 M) - Input/output data for Kincaid SO2: Flat, Rural, Non-downwash, Developmental

Lee Wind Tunnel (ZIP) (13 M) - Input/output data for Lee Wind Tunnel: Flat, Rural, Downwash, Independent

Lovett (ZIP) (9 M) - Input/output data for Lovett: Terrain, Rural, Non-downwash, Developmental

Martin's Creek (ZIP) (11.5 M) - Input/output data for Martin's Creek: Terrain, Rural, Non-downwash, Independent

Millstone (ZIP) (660 K) - Input/output data for Millstone: Flat, Rural, Downwash, Developmental

Prairie Grass (ZIP) (342 K) - Input/output data for Prairie Grass: Flat, Rural, Non-downwash, Developmental

Tracy (ZIP) (2.5 M) - Input/output data for Tracy: Terrain, Rural, Non-downwash, Independent

Westvaco (ZIP) (10 M) - Input/output data for Westvaco: Terrain, Rural, Non-downwash, Independent

CAL3QHC/CAL3QHCR

CAL3QHC is a CALINE3 based CO model with queuing and hot spot calculations and with a traffic model to calculate delays and queues that occur at signalized intersections; CAL3QHCR* is a more refined version based on CAL3QHC that requires local meteorological data.

* Please note, the grace period for the use of CAL3QHCR in PM hot-spot analyses has ended. All new PM hot-spot analyses begun after January 20, 2020 must use **AERMOD**. For more information, refer to EPA's refer to EPA's [Revisions to the Guideline on Air Quality Models final rule \(PDF\)](#) (54pp, 743 K, published January 17, 2017).

CAL3QHC/CAL3QHCR Model Code and Documentation
Model Code
CAL3QHC Executable (ZIP) (235 K) CAL3QHCR Executable (ZIP) (917 K)
Model Documentation
CAL3QHC User's Guide (PDF) (98 pp, 2.4 M, 1995) Latest CAL3QHC Model Change Bulletin (TXT) (5 K, 2004) CAL3QHCR User's Guide (PDF) (96 pp, 209 K, 1995) Latest CAL3QHCR Model Change Bulletin (TXT) (3 K, 2013)

CTDMPLUS

Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS) is a refined point source gaussian air quality model for use in all stability conditions for complex terrain. The model contains, in its entirety, the technology of CTDM for stable and neutral conditions. [CTSCREEN](#) is the screening version of CTDMPLUS.

CTDMPLUS Model Code and Documentation
Model Code
Code/Executable/Test Case (ZIP) (842 K)
Model Documentation

[User's Guide Supplement \(PDF\)](#) (5 pp, 60 K, 1993)
[User's Guide, Volume 1 \(PDF\)](#) (210 pp, 7 M, 1989)
[User's Guide, Volume 2 \(PDF\)](#) (77 pp, 2 M, 1990)
[User's Guide for Terrain Preprocessor \(PDF\)](#) (180 pp, 6 M, 1988)
[User's Guide for Meteorological Preprocessor \(PDF\)](#) (166 pp, 5 M, 1989)
[Final Report \(PDF\)](#) (484 pp, 16 M, 1987)
[Latest Model Change Bulletin \(TXT\)](#) (5 K, 1993)

OCD

Offshore and Coastal Dispersion Model Version 5 (OCD) is a straight line Gaussian model developed to determine the impact of offshore emissions from point, area or line sources on the air quality of coastal regions. OCD incorporates overwater plume transport and dispersion as well as changes that occur as the plume crosses the shoreline. Hourly meteorological data are needed from both offshore and onshore locations.

OCD Model Code and Documentation
Model Code
Code/Executable (ZIP) (9 M)
Model Documentation
User's Guide (ZIP) (369 M) User's Guide Supplement (PDF) (204 pp, 3 M, 1989) Latest Model Change Bulletin (TXT) (6 K, 2000)

LAST UPDATED ON JULY 10, 2020