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Fact Sheet
Computer Modeling: Dispersion Models

What is dispersion modeling used for?

Air dispersion models estimate the atmospheric transport and fate of a pollutant from the point of emission to the location of impact, to arrive at ambient air concentration estimates of the pollutant. The transformation (fate) of an airborne pollutant, its movement with the prevailing winds (transport), its crosswind and vertical movement due to atmospheric turbulence (dispersion), and its removal amounts due to dry and wet deposition are influenced by the pollutant's physical and chemical properties and by meteorological and environmental conditions. Factors such as distance from the source to the receptor, meteorology, intervening land use and terrain, pollutant release characteristics, and background pollutant concentrations affect the predicted air concentration rate of an air pollutant. Estimates of the amount of gaseous and particulate material deposited by wet and dry process on outdoor surfaces are also necessary to assess impacts of toxic air pollutants.

Which dispersion model should you use?

The choice of a model and the way it is applied will depend on numerous factors such as:

- spatial scale (for example, national, regional, or local)
- temporal scale (for example, hourly, daily, or annual)
- type of pollutant (for example, gaseous, particulate, reactive)
- terrain (for example, simple, complex)
- type and number of receptors
- emission source type (for example, stationary, mobile)
- availability of input data (for example, meteorological data, census data)
- an acceptable level of uncertainty in the model's results.

By understanding the different features of individual models, you'll be able to select a model whose features are most critical to your objective. Even within a model there are modeling options, allowing the model to run in different ways as you choose. For example, you may choose to disregard effects of downwash from a building or estimate the amount of pollutant removed due to dry and wet deposition.

For guidance on determining which model is most suitable, you should refer to the Guideline on Air Quality published in the Code of Federal Regulations (see "Where can you find more information?" below).

What dispersion models are available?

Described below are only a few of the air quality (dispersion) models available through EPA. For a more complete description, and for background on such terms as "Gaussian model," see the Guideline on Air Quality Models and the user's guide for the individual model (see "Where can you find more information?" below).

- ISC (Industrial Source Complex Model) is a steady-state Gaussian model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex to a distance of 50 kilometers. Now with its third generation (ISCST3), in addition to air concentrations, it can estimate deposition rates and is appropriate for simple and complex terrain.
- ASPEN (Assessment System for Population Exposure Nationwide) is a Gaussian model used to estimate toxic air pollutant concentrations over a large-scale domain such as the entire continental U.S.
- AERMOD is a steady-state plume-based model designed to estimate near-field impacts from a variety of industrial source types. This model takes into account the effect of planetary boundary layer turbulence on air dispersion. It is being considered as a replacement to the ISCST3 model.
- REMSAD (Regulatory Modeling System for Aerosols and Deposition) is a three-dimensional grid-based model designed to simulate long-term (for example, annual) concentrations and deposition fluxes of atmospheric pollutants over a large geographic domain (for example, Southeast U.S.). Currently REMSAD can address toxic pollutants such as mercury, cadmium, chlorinated dibenzodioxins, polycyclic organic matter, and atrazine. Other air toxic pollutants may be added in the future.

What screening tools are available?

Before conducting a refined modeling analysis using a model like one of those above, you may opt to employ a simpler model as a screening tool that produces a conservative air concentration estimate. Screening models use default assumptions and may be used to rule out the need for further analyses. Below are two of the screening models available through EPA:

- SCREEN3 is a Gaussian plume dispersion model designed to use worst-case meteorology to estimate one-hour average air concentration estimates.
- CTSCREEN (Complex Terrain Screening model) is a Gaussian plume dispersion model designed to assess plume impaction in complex terrain.

Where can you find more information?

For more information on these and other air dispersion models, visit our Support Center for Regulatory Air Models (SCRAM) at http://www.epa.gov/ttn/scram. The Guideline on Air Quality Models recommends air quality modeling techniques and also provides general information concerning air quality models and their use (general information addresses suitability of various models, classes of models, and levels of sophistication of models). The Guideline is published at 40 CFR Part 51, Appendix W, and it is accessible through the SCRAM website at http://www.epa.gov/ttn/scram/guidance/guide/appw_01.pdf.