Minnesota Pollution Control Agency

Majors and Remediation Division
In consultation with the Minnesota Department of Health

Citizens' Guide to Air Dispersion Modeling

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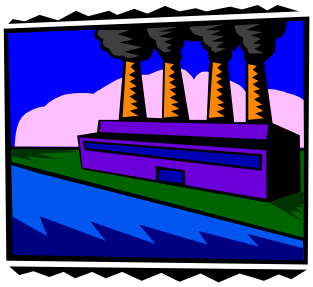

This fact sheet describes a scientific technique called air dispersion modeling used to analyze how chemicals move in the air. This analysis is used routinely by the Minnesota Pollution Control Agency (MPCA) in crafting air quality permits that comply with state and federal regulations.

What is air dispersion modeling?

Air dispersion modeling is a computer simulation. By feeding facts into the simulation, the MPCA can develop predictions about how concentrated air pollutants will be at specific locations around a facility or in the surrounding area.

Why can't the MPCA simply measure the levels of air pollutants at key locations, instead of trying to predict?

Actual readings of chemicals can be very helpful, but they can't tell the whole story about how pollutants move and change in the air. If you think about measuring chemicals in the soil versus the air, it is easy to understand why air pollution is much harder to detect or predict.

To find out if soil contains a chemical, scientists take a sample (or a number of samples) and test for the presence of the chemical. Test enough samples at different depths and locations, and you can develop a relatively accurate picture of how the chemical is distributed in the dirt. The chemical stays put, making it easier to find.

To find out if air contains a chemical, scientists are faced with a much tougher task. There are additional uncertainties about how a chemical is diluted, changed, or moved as it disperses into the air. There are uncertainties posed by the weather – wind, sun, and temperature. In addition, the air sample is taken over a specific time period; therefore, the concentration measured is the average concentration over that time period.

Air dispersion modeling is really the only practical way to factor in all of these influences on chemicals in the air. The model provides a good statistical prediction about the chemical and its movement. While the results aren't perfect, they are much more helpful in making decisions than air sampling at limited locations, fixed times, and changing weather conditions.

When is air dispersion modeling used?

Dispersion modeling is used whenever the MPCA or others want an estimate about the pollution concentrations attributable to a source (or group of sources).

Examples include:

- Determining whether a permitted facility is complying with state or federal requirements.
- Assessing where might be the best location to site an air monitor that reads actual data.
- Deciding whether emissions from a facility (existing or proposed) pose a threat to public health or the environment.

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What pollutants can be evaluated using air dispersion modeling?

Many types of air pollution can be modeled. Different air dispersion models will be used for different pollutants. The U.S. Environmental Protection Agency (EPA) publishes "Guideline on Air Quality Models" to recommend models that regulators should use.

It is helpful to think about two general types of air dispersion modeling: typical regulatory modeling and specialized models. Typical regulatory modeling is used for emissions that are continuous and are assumed not to change into other chemicals. Specialized modeling is used for pollutants, such as ozone, that are formed from other chemicals.

What sources can be evaluated using air dispersion modeling?

Typical regulatory modeling can simulate a point source (a smokestack, for example), a two-dimensional source (fugitive dust from a road that is wide and long), or a three-dimensional source (fugitive dust from a large coal pile that is wide, long and tall). Modeling also works for sudden one-time emissions (an explosion).

What information do scientists feed into an air dispersion model?

That will depend upon the model, but a list of basic information input into the computer simulation may include:

- Pollution emission rates (often the maximum possible amount emitted by a source operating at full capacity);
- Size and height of the pollution source;
- Temperature of the emissions;
- Speed of the emissions as they leave the source;
- Historic wind speed and direction;
- Historic temperature and other weather data; and
- Nearby building and land contours.

How do air dispersion modeling predictions help protect the public?

The models simulate a "worst case" situation – the sources operating at full capacity around the clock under the worst possible weather circumstances. Decisions on how to regulate are based on this worst-case assumption, rather than on normal or average conditions.

When does the MPCA require air dispersion modeling?

Federal regulations require dispersion modeling in some cases, such as when a facility expansion might cause it to emit pollutants above acceptable thresholds.

The MPCA also requires certain large facilities (called "major" facilities) to submit modeling data when they apply for an air quality permit or renewal.

Local air monitoring may be required under some federal regulatory programs – usually when there are specific concerns about a pollutant.

Who performs air dispersion modeling?

Facilities applying for permits (or their paid consultants) typically perform dispersion modeling analyses for specific sources. The MPCA supplies data, must approve the inputs, and sometimes perform supplemental modeling. The MPCA and in some cases the EPA review the results and must approve the work for the study to be considered acceptable.

Does the MPCA try to take into account the general air quality (background level) when assessing modeling analyses?

Yes. The 'background' air quality (general concentration of pollutants in the air, not including the sources in the study) is part of some calculations. Background air concentrations include pollution from natural sources, known sources near the facility being studied and unidentified sources. When available, data from nearby monitoring stations – exact readings of the pollution levels — are combined with the modeling data. In some cases, where another large source is located near the facility, explicit modeling will take that other source into account. In analyses looking at complex mixtures of pollutants, background data is often unavailable.

In urban areas, vehicles and smaller businesses can be important background sources of some air toxics, such as benzene (a component of petroleum products) and formaldehyde (a preservative found in some building materials). Some pollutants, such as carbon tetrachloride (a cleaning fluid) and mercury (a metal) persist a long time in the environment, affecting ambient air quality. Still other pollutants (such as ozone) are formed from other chemicals and are detected in the ambient air.

Does the MPCA have an inventory of all air pollution sources in the state?

The MPCA has this information for facilities that have air quality permits. Smaller commercial sources, such as gas stations and dry cleaners, are not required to submit information on air emissions to the MPCA.

Other sources of pollutants move from place to place (vehicles, for example), while still others are completely unpredictable (forest fires, for example).

The MPCA's air toxics emission inventory, combined with the facility criteria pollutant inventory, is as close to an air pollution inventory as Minnesota has. It uses as much information as is available, but because the data isn't complete, the results are only an estimate.

What is a 'fugitive' emission?

A fugitive emission is one that "gets away" from existing pollution control technology or the facility. If a facility worker opens a window while performing an industrial task involving harmful chemicals, vaporized chemicals that leaks out the window are called fugitive emission. Many fugitive emissions, such as wind-blown dust from a coal pile, are emitted during routine facility operation. Fugitive emissions are taken into account in air dispersion models.

Can the MPCA do air dispersion modeling for odors?

Modeling odor is very complex, for a number of reasons:

- Odor can be caused by one chemical or many mixed together.
- Odors mixed together may have a different odor than the individual odors.
- Odor can be offensive below levels that would trigger any regulatory action.
- Odors dissipate, rather than stay in one place.
- Some people are more sensitive to odors than others.
- Odors are subjective. What might smell great to you might smell awful to your next-door neighbor.
- Even though most odors are the result of brief exposures, modeling provides estimates of concentration over longer time periods.

Research on odor modeling continues, but it is difficult to predict odor problems.

How can I find out the results of air dispersion modeling for a facility?

There are several ways that citizens can find out about air dispersion modeling for specific facilities:

- Call the environmental manager or other representative of the facility and ask for the results.
- Contact the MPCA and request to speak to the air quality engineer who works with the facility.
- Contact the MPCA to set up an appointment to view the facility file, and any air dispersion modeling analysis should be included. Keep in mind that you may need help in interpreting the information.

Not all air dispersion modeling will be available for review. If some chemical or process a facility uses is considered a trade secret, it may not be public data.

How can I improve air quality in my community?

If you want to improve air quality, start first with those emissions that are within your control – driving, fueling your car, stirring up dirt or dust in your yard, burning wood, dumping solvents that evaporate in the driveway.

If an odor, dust, or other air quality problem is reducing your quality of life or affecting your health, file a complaint – with your city, county or the MPCA. Complaints can be filed online at http://www.pca.state.mn.us/complaints.html.

For more information…

Visit the MPCA Web site: http://www.pca.state.mn.us/air/modeling.html.

Visit the EPA Support Center for Regulatory Air Modeling at: http://www.epa.gov/scram001/

You can also contact the MPCA staff member working with the facility or call the general information number: (651) 296-6300, toll-free/TDD (800) 657-3864.

The MPCA contact is:

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