

Air Toxics Program

Acceptable Ambient Levels (AALs)

What is the Acceptable Ambient Level?

At the outset of its air toxics program, North Carolina decided that the philosophy of the program would be based upon protection of public health. It established airborne concentration of chemicals “*above which the substance may be considered to have an adverse effect on human health.*” The chemicals became known as toxic air pollutants or TAPs and the concentrations became known as acceptable ambient levels or AALs. AALs are expressed in weight per unit volume, most often as milligrams per cubic meter of air (mg/m³). North Carolina has developed AALs for 97 toxic air pollutants. By their nature, AALs are intrinsically different from measured air concentrations, and an understanding of this distinction is necessary to prevent misunderstanding and misapplication of AALs.

How are AAL’s determined?

Historically, AALs were established by two means:

- (1) For health effects other than cancer, the AALs were determined by taking occupational exposure standards and lowering exposure guidelines to acceptable concentration levels by safety factors of 10 to 160. Safety factors were used because the state recognized that chemical compounds differed in the nature and severity of the toxic effects and how much was known about the health effects of a chemical. Generally speaking, highly toxic chemicals such as mercury have larger safety factors and lower AALs. (Occupational exposure standards are essentially “no effect levels” and as such, safety factors tend to decrease those standards well below the levels at which adverse health effects have been seen in occupationally exposed humans).
- (2) For substances known to cause cancer (carcinogens) in humans, AALs are set at levels calculated to represent an increment of “one in a million” risk. That is, if one million individuals are exposed continuously for 70 years, to a carcinogen at the concentration of the AAL, one person might be expected to contract cancer as a result of that exposure. For “probable” human carcinogens, the risk levels increase to “one in one hundred thousand” and “one in ten thousand,” respectively.

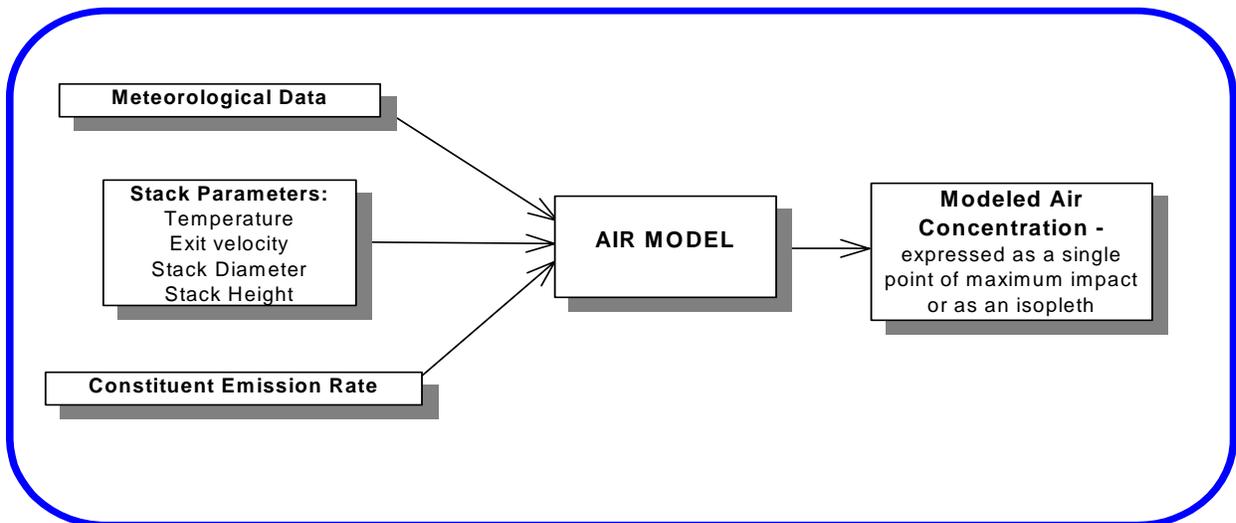
Currently, the North Carolina Division of Air Quality maintains a scientific body of experts known as the Scientific Advisory Board (SAB) whose job it is to continually review the scientific information that forms the basis of the AALs. As this information changes, the SAB recommends updates to the AALs. The SAB reviews tend to be more complex than those used at the beginning of the Toxics program, but the objective is the same: to recommend safe exposure concentrations for toxic air pollutants that allow an ample margin of safety for potentially exposed people.

How does an AAL compare to National Ambient Air Quality Standards (NAAQS)?

North Carolina's air toxics program does not set state-wide or even community ambient standards for TAPs in the same sense as national air standards are set for familiar air pollutants such as ozone, nitrogen oxides or carbon monoxide, which are called "criteria air pollutants". National air quality standards set specific limits for ambient concentrations of pollutants (NO_x, SO₂, Pb, CO, VOC, and particulate matter) in the air we all breathe, and every state is expected to meet the national standards. States have extensive air monitoring programs designed to monitor for criteria air pollutants to ensure that compliance with the national standards is being maintained. Wide-ranging pollution control strategies and national rules have been adopted to enable states to meet the standards for the criteria pollutants. By contrast and although termed "acceptable ambient levels," North Carolina's AALs are used in pollution permitting to insure that toxic air pollutants from new or modified facilities do not make toxic air pollutant levels worse, on a case by case basis. Generally, monitoring for toxic air pollutants is limited to specific areas and specific pollutants.

How can you determine if the toxic air pollutant levels are okay?

When contrasted to the national standards, AALs are applied on a much smaller scale. Since there is not enough monitoring information to be able to know the general ambient concentrations for each of the 97 TAPs, the North Carolina program focuses on what a facility *adds to the existing environment*. What a facility adds to the environment is determined in a two step process. First, the facility determines how much of a toxic air pollutant it emits. Determining emissions can be difficult, but generally there are standard techniques available. For example, a facility can perform testing at its emissions points to determine emission quantities and rates. If available, a facility may also use a published "emission factor" that has been determined to be a typical emission rate for a particular pollutant from a generic source such as spray booths. If the pollutant is emitted from the emission source at a rate above what is allowed by the toxics program, then an air dispersion computer model is run. If the air dispersion model results show that the

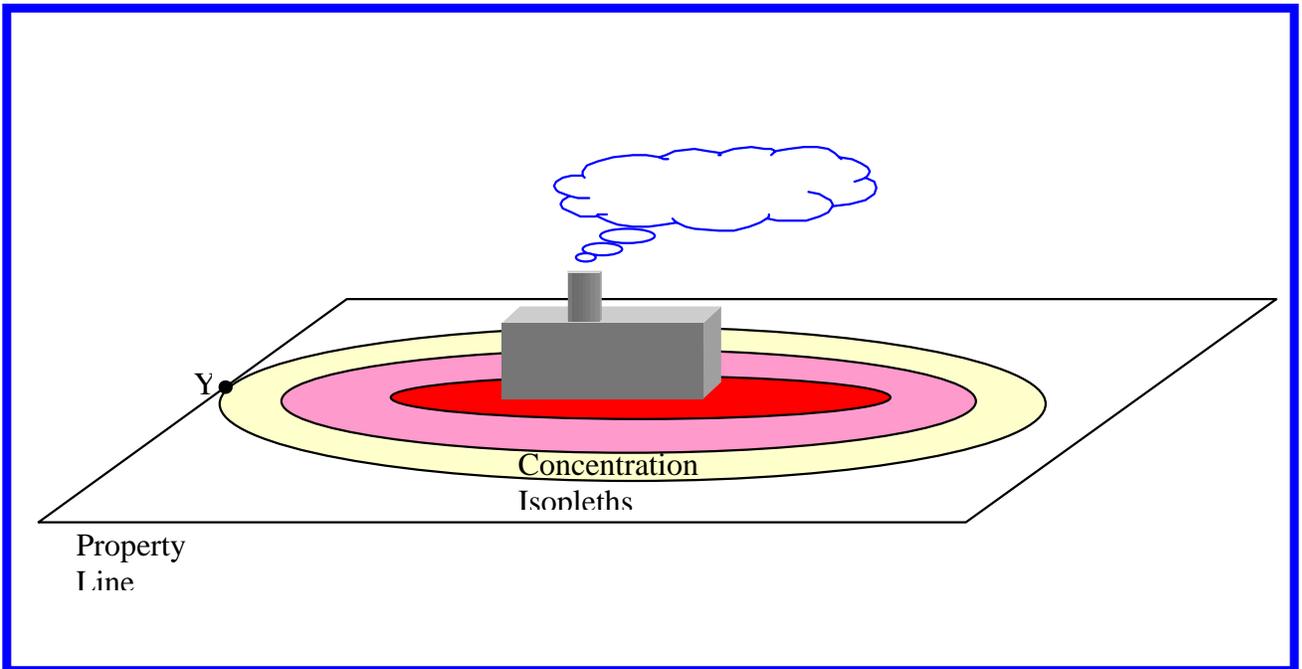


Overview of air modeling

toxic air pollutant emission is below the AAL, a conclusion is made that the facility has not *added concentrations of toxic air pollutants to the air* that are harmful to human health.

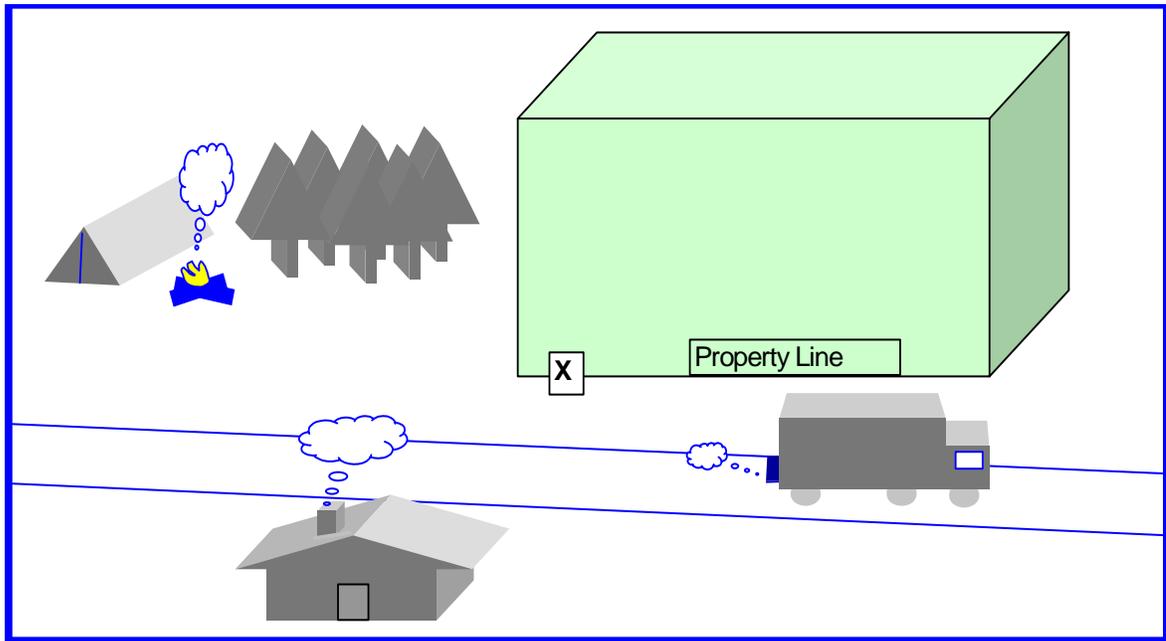
What is an air dispersion model?

Air dispersion computer models use mathematical equations to simulate the real world. These equations attempt to account for all conditions affecting the release and dispersal of a pollutant, such as wind speed, wind direction, temperature, terrain, height of the emissions, how fast the emissions are released and so on. The model is used to predict the downwind concentrations or off-site concentrations of a given pollutant from the input information. The model output can show a picture of areas of equal concentrations or *isopleths*. Isopleths can illustrate the highest pollution levels. Since air modeling is conducted only for the source of interest, the resulting modeled air concentration is directly comparable to the AAL. A graphical representation of the modeled air concentration is given below.



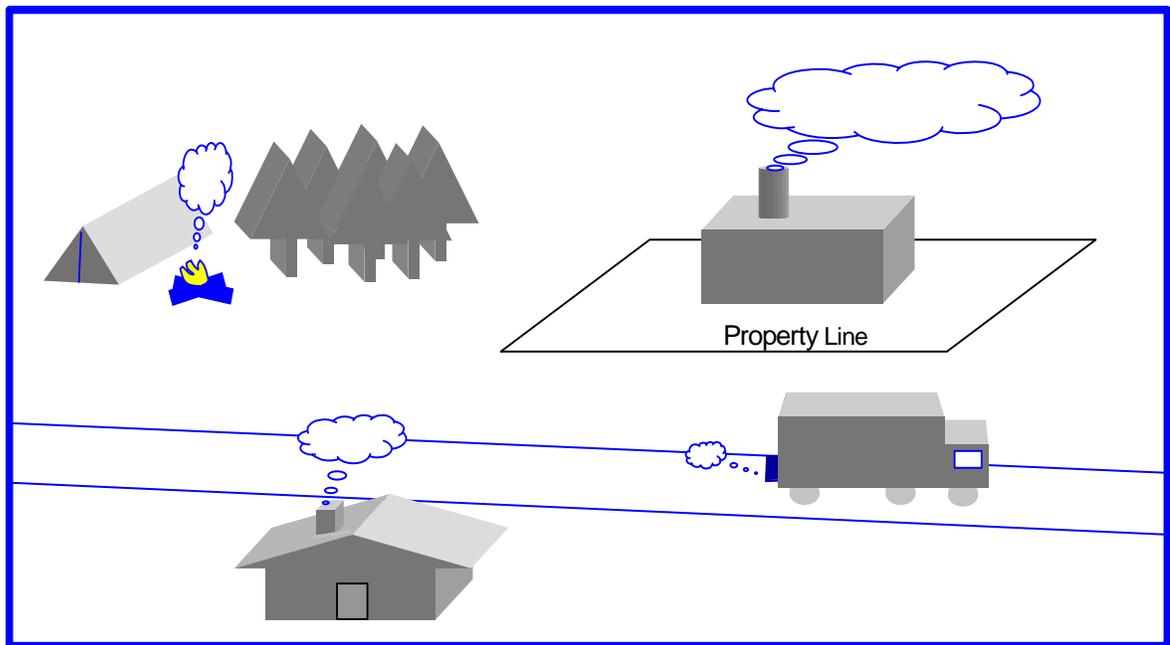
A model predicts ambient air concentrations but does not account for contributions from other sources. The AAL is not to be exceeded at the closest property point, y.

How are AALs related to measured air concentrations? At first glance, AALs may appear to be directly comparable to air concentrations measured during ambient monitoring. However, such comparisons are misleading. Although a constituent of interest may be emitted from several different sources, its AAL is applicable only to the portion of the air concentration emitted from a specific industrial source. The figure below illustrates how emissions from all sources contribute to the air concentration or total loading. The NAAQS for the criteria air pollutants are established and monitored with total loading as a consideration.



Source of interest isolated from other sources during monitoring at point X. This is an unrealistic scenario.

When monitoring for toxic air pollutants is conducted, the measured air concentration for a particular air pollutant can usually only be compared with its AALs if the source emitting that pollutant can somehow be *isolated* from all other sources, as depicted in the figure below. Such isolation is usually not possible or realistic. Furthermore, because air monitoring measures the total loading of a constituent from all emission sources, the resulting measurement is likely to be greater than the AAL for that constituent. Many volatile organic compounds such as benzene and arsenic can be found in a sample of ambient air in concentrations above the AAL. If such a sample were taken at the property line of a facility, it would not automatically imply that a given facility has exceeded an AAL.



Multiple emission sources all contribute to the ambient air concentration

Additional information would be needed to draw appropriate conclusions about what the sample represented. Such additional information has to include information about all other contributing sources, near-site meteorology and the dispersion characteristics of released emissions.

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