D.2.3.1 Wind Speed and Direction

AERMOD assumes that wind speed is constant from one direction for a given time period being modeled, usually one hour. Wind speeds are usually measured by an anemometer at a height of 20 feet. These measurements may or may not be corrected by the air quality analyst to account for increasing wind speed with height.

For those time periods in which the wind speed is given as zero or "calm", dispersion models will generally assign a minimum wind speed. If a wind speed of zero is specified, AERMOD computes an infinite concentration of the pollutant at the source, with no dispersion. In reality, diffusion of pollutants into the surrounding atmosphere would take place in calm conditions.

Atmospheric stability is related to the turbulence of the atmosphere and is determined by a combination of wind speed, cloud cover, and solar radiation.

In unstable atmospheric conditions, high turbulence and associated vertical mixing produce a peak ground-level pollutant concentration near the emission source. In stable atmospheric conditions, a low level of vertical mixing results in low ground-level steady-state concentrations near the source. In most cases, the most unstable atmospheric conditions occur during daylight hours, with low wind speeds and high solar radiation. The most stable atmospheric conditions occur at night, during times of low wind speeds and clear skies.

D.2.3.2 Mixing Height

The term "atmospheric mixing height" generally describes the height above ground level (AGL) where most air pollutants are generated and where atmospheric mixing occurs. Within the atmosphere, this height (expressed in meters or feet AGL) is determined by an assortment of factors including air temperature, humidity, solar radiation, wind speed, and topographic features on the ground (i.e., valleys, mountains, vegetative cover, reflective and impervious surfaces, water bodies, etc.). The atmospheric mixing height is dynamic and moves up or down both spatially and temporally throughout the day, season, and year with corresponding changes in these abovementioned factors. The height of this mixing layer generally ranges between 1,000 and 6,000 feet AGL.

The presence of a stable layer above the mixing layer has the effect of restricting vertical diffusion of pollutants. This "lidding" effect requires a modification for it to remain accurate at distances greater than several kilometers downwind of the emission source. For applications such as airports, however, where the pollutant of concern is not likely to be transported at high concentration very far from the source, mixing depth effects on downwind pollutant concentrations may be ignored without too much loss of accuracy.

The EPA has established guidelines for the determination of atmospheric mixing heights used for computing an emission inventory and for conducting atmospheric dispersion modeling. In Section 5.2.2 (*Mixing Height Determination*) of the *Guideline on Air Quality Models*[76], the following preamble discusses the application of mixing heights as it applies to aircraft emissions:

[76] Appendix W to Part 51 – *Guideline on Air Quality Models*, http://www.ecfr.gov/cgi-bin/text-idx?SID=e6a5b817b94abf58460f48c032d9a39c&node=40:2.0.1.1.2.23.11.5.37&rgn=div9.