

METEOROLOGICAL TECHNIQS IN AIR POLLUTION SURVEYS

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THE INDUSTRIAL hygienist is accustomed to being closely associated professionally with diverse scientific disciplines, and in the past his work has brought him into contact with many specialties in the life and physical sciences. Because of the increasing degree to which he participates in air pollution studies, it is now required that he learn to use some of the tools and technics of the meteorologist.

One ordinarily thinks of meteorology as being concerned with the behavior of large air masses. In air pollution investigations we are usually interested in more localized meteorological phenomena, such as those which govern the rate at which a contaminant is diluted in the immediate vicinity of a stack. This discussion will be concerned specifically with the factors which affect the dilution of effluents discharged from stacks and thereby influence the concentration of a pollutant at ground level.

Except for localities in which there are unusual topographical complications, the ground level concentration at a given distance from a stack of known height, emitting a pollutant at a known rate, can be approximated if a comparatively few meteorological data are available.

In addition to wind speed and direction, atmospheric turbulence has an important influence on the pattern of ground level concentration. Atmospheric turbulence is quite variable and is governed largely by the vertical temperature gradient of the atmosphere. During the daylight hours, and particularly under a clear sky, the earth absorbs solar radiation more rapidly than the atmosphere, and the surface of the earth becomes warmer than the air above. Under these conditions, there is a linear decrease in temperature with height above the ground level. This vertical temperature gradient is known as the lapse rate. With a negative gradient, as normally exists during the daylight hours, the atmosphere is turbulent (unstable) and the dilution of a stack effluent is comparatively rapid. This condition is illustrated in figure 1.

Toward evening the earth and its atmosphere no longer receive significant amounts of solar radiation, and the heat which has been stored during the daylight hours is gradually lost by radiation back into space. Under these conditions the earth is losing heat more rapidly than is its atmosphere, and in the early evening hours the thermal gradient is apt to "invert" as the earth becomes cooler than the air above. The air is very stable during this period when the vertical temperature

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