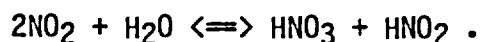


Nitrogen dioxide is formed in the atmosphere mainly from the oxidation of NO by ozone and various free radicals (see, for example, Bottenheim et al., 1977; Calvert et al., 1978; Altshuller, 1979). It dissolves in water according to a fairly complex chemical mechanism (Sherwood and Pigford, 1952), the overall reaction being



As can be seen from the above reaction, the solubility of NO₂ will, like that for SO₂, depend on the acidity of the rain or cloud droplet, and laboratory experiments (Beilke, 1970) have shown the scavenging coefficient of NO₂ to be roughly one-quarter that for SO₂. Experiments on dry deposition rates of NO₂ to a number of surfaces have shown the deposition velocity of NO₂ to be roughly one-half that for SO₂ under comparable conditions (see Table 7). No wet and dry deposition data for NO₂ under wintertime conditions are available, especially to snow, but it seems reasonable that qualitatively the same differences in winter and summertime deposition behavior will obtain as for SO₂.

As far as atmospheric chemistry is concerned, NO₂ is formed so quickly from NO under summertime conditions that, in mathematical modeling of long-range transport (where time steps of the order of several hours are involved in the calculations), as a first approximation emissions can probably be assumed to consist of NO₂ (i.e., the role of NO as an independent precursor species of nitrates and PAN can be neglected). This may not be true under nighttime conditions, or in the winter at northerly latitudes, but the scope of this report does not allow for more detailed speculation on this point.

Nitric acid is now thought to be one of the major products of NO emissions (e.g., see Spicer, 1979; Spicer et al., 1980). Under typical atmospheric conditions, it exists mainly in the vapour form. However, it is a highly soluble vapour (e.g., Okita and Ohta, 1979), and potentially has a higher scavenging coefficient than that of SO₂ (no experimental data are available to verify this). There are also reports of unpublished experimental results, which suggest that, unlike SO₂, HNO₃ is scavenged very efficiently by snow. Thus, even though no experimental data are available on wet removal