efficiently during collision with a water molecule to form an important transient species in the atmosphere, the hydroxyl radical:

$$O(^1D) + H_2O \longrightarrow 2HO \qquad (35)$$

This radical is also formed through the photodecomposition of nitrous acid (HONO):

$$HONO + \text{sunlight (290-400 nm)} \longrightarrow HO + NO. \qquad (36)$$

The hydroxyl radical can react with nitric oxide to give back nitrous acid:

$$HO + NO + M \longrightarrow HONO + M, \qquad (37)$$

or form nitric acid by reacting with nitrogen dioxide:

$$HO + NO_2 + M \longrightarrow HONO_2 + M. \qquad (38)$$

It has been shown that the reaction sequence 20 through 38 cannot explain the rapid conversion of NO to NO_2 observed in the ambient atmosphere (Leighton, 1961; Altshuller and Bufalini, 1965; Demerjian et al., 1974). In fact, if these reactions alone occurred, the original supply of nitrogen dioxide in our atmosphere would be only slightly depleted under irradiation with sunlight, and a small and near constant level of ozone would be created in a few minutes. The key to the observed nitric oxide to nitrogen dioxide conversion lies in a sequence of reactions between the transient species present and other reactive molecules such as the hydrocarbons and aldehydes present in the polluted atmosphere.

In the presence of hydrocarbons, the number of reactions greatly increases. Thus, the hydroxyl radicals produced by reactions 35 and 36 can react with a hydrocarbon (paraffin, olefin, aromatic, or any compound having C-H bonds):

$$OH + \text{Hydrocarbon} \longrightarrow R + H_2O. \qquad (39)$$