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

$$HONO + \text{sunlight (290-400 nm)} \rightarrow HO + NO \quad (6\text{-}17)$$

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

$$HO + NO + M \rightarrow HONO + M \quad (6\text{-}18)$$

or form nitric acid by reacting with nitrogen dioxide:

$$HO + NO_2 + M \rightarrow HONO_2 + M \quad (6\text{-}19)$$

Demerjian et al.[106] have shown through computer simulations of the reaction sequence 6-1 through 6-19 that these reactions cannot explain the rapid conversion of NO to NO_2 observed in the ambient atmosphere. In fact, if these reactions alone occurred, the original supply of nitrogen dioxide in our atmosphere would be 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 6-16 and 6-17 can react with a hydrocarbon (paraffin, olefin, aromatic, or any compound having C-H bonds):

$$OH + \text{Hydrocarbon} \rightarrow R \quad + H_2O \quad (6\text{-}20)$$