and by acid-catalyzed polymer decomposition. Physical, chemical or bacterial actions, resulting from available air pollutants, can contribute to deterioration and corrosion of these different types of materials.

Possibly the most difficult aspect, when viewed from an international perspective, will be the separation of the effects attributable to local emissions of gas and aerosols from those associated with transboundary flow.

Loading/Effects Relationship

A number of different approaches have been examined to assist in the task of deriving relationships between parameters of acid loading and system response. These models are all under active development, and in the aquatic sector they have advanced to the point where a preliminary application is possible, although it is important to stress that full validation remains to be achieved.

One model (Dickson), based on Scandinavian data, indicates that annual sulphate loadings of less than 15 to 17 kg/ha would be unlikely to degrade "moderately sensitive" lakes. The most sensitive lakes and streams are likely to be on the borderline of potential effects at an annual sulphate loading rate greater than 9 to 12 kg/ha.

A second model (Henriksen), also based on Scandinavian data, shows that precipitation pH of 4.5, and lakewater SO_4^{2-} concentration of 60 μeq/l, are the maximum tolerable for lake waters with 50 μeq Ca/l or more. This in-lake concentration of sulphate converts to a precipitation sulphate concentration of about 40 μeq/l The predicted reduction in precipitation sulphate concentrations to 40 μeq/l in heavily loaded areas is needed to improve the pH from about 4.2 to about 4.5 in order to protect moderately sensitive lakes. Highly sensitive lakes and streams may be protected at predicted precipitation levels of sulphate of 21 μeq/l, which should result in a pH of about 4.8 units.

A third model (Loucks et al), based on North American data, combines the physiological sensitivity of early life stages of fish to acute effects of H^+ and Al^{3+} with data on pH during flushing event (snowmelt or heavy rain). These data show that a pH depression (ΔpH) of 0.7 to 1.0 which will cause a response of substantial physiological significance. Given this dose/response relationship, a loading threshold may be defined as the episodic sulphate loading which, when subjected to a defined flushing event leads to the minimal biologically significant short-term H^+ and Al^{3+} exposure. This model suggests that a sulphate loading of 5 to 7 kg/ha/yr produces a critical surface water response (ΔpH in the range of 0.7 to 1.0) for streams in sensitive areas: a loading threshold of 7 kg SO_4^{2-}/ha/yr converts to about 21 μeq SO_4^{2-}/l (assuming 70 cm/yr precipitation).