

measured. It is recognized that dry deposition of sulphate and sulphur dioxide, and the wet and dry deposition of nitrogen oxides, nitric acid, particulate nitrate and ammonia, as well as other compounds also contribute to acidic deposition. Based on documented effects, wet and dry deposition of sulphur compounds dominate in long-term acidification.

Sulphur deposition also predominates in the majority of cases surveyed involving short-term pH depressions and associated effects. Insufficient data are available to relate nitrate deposition to short-term water quality effects. Therefore, we are unable to determine a nitrate dose-response relationship.

The models, which are based on theory, that have been considered, permit a quantification of the target loadings in terms of geochemical basin sensitivity. Although these models require further validation, the derived loading estimates are generally supportive of the empirical observations for the study areas discussed above.

Based on the results of the empirical studies, interpretation of long-term water quality data, studies of sediment cores and models that have been reviewed, we conclude that acidic deposition has caused long-term and short-term acidification of sensitive (low alkalinity) surface waters in Canada and the U.S. The Work Group concludes on the basis of our understanding of the acidification process that reductions from present levels of total sulphur deposition in some areas would reduce further damage to sensitive (low alkalinity) surface waters and would lead to eventual recovery of those waters that have already been altered chemically or biologically. Loss of genetic stock would not be reversible.

The Canadian members of the Work Group propose that present deposition of sulphate in precipitation be reduced to less than 20 kg/ha.yr in order to protect all but the most sensitive aquatic ecosystems in Canada. In those areas where there is a high potential to reduce acidity and surface alkalinity is generally greater than 200  $\mu\text{eq/L}$ , the Canadian members recognize that a higher loading rate is acceptable.

As loading reductions take place and additional information is gathered on precipitation, surface water chemistry and watershed response, it may be possible to refine regional loading requirements.

## 1.2 AQUATIC ECOSYSTEM EFFECTS - UNITED STATES

Acidic deposition has been reported in the literature as a cause of both long-term and short-term episodic depressions in pH and loss in alkalinity in some lakes and streams in the U.S. and Canada.