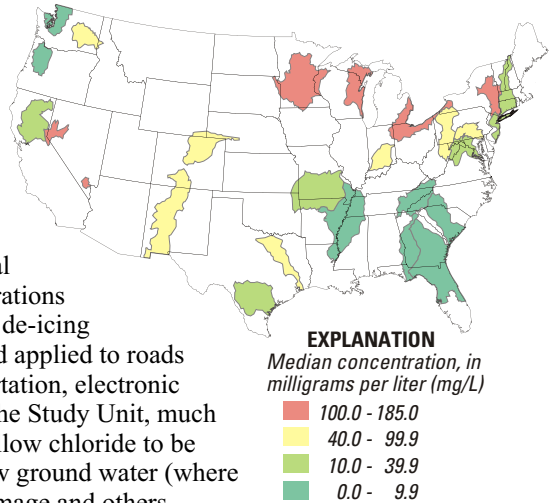
CHLORIDE IN A NATIONAL CONTEXT--CONCENTRATIONS ARE GREATEST IN NORTHERN URBAN AREAS



Chloride concentrations in urban streams of the Study Unit were substantially greater than in most urban streams sampled throughout the Nation. Median chloride concentrations in ground water overlain by urban areas in the Study Unit were also greater than the national median, although not substantially. Elevated chloride concentrations result from runoff of de-icing chemicals applied to roads and highways during winter storms (Granato, 1996). Because winter conditions are similar across the North-Central and Northeastern United States, the greater median chloride concentrations in other northern Study Units may also be at least partly the result of de-icing compounds. Sodium chloride (salt) is the primary de-icing compound applied to roads and highways in the Study Unit (Minnesota Department of Transportation, electronic commun., 2000). The environmental setting of the urban portion of the Study Unit, much of it covered with permeable sandy soils, wetlands, and lakes, may allow chloride to be more readily transported to and stored in lakes, wetlands, and shallow ground water (where chloride can persist) as well as being flushed directly to streams. Talmage and others (1999) reported that chloride concentrations were positively correlated with impervious areas (buildings and paved surfaces) in 13 urban streams of the Study Unit. The source of elevated chloride concentrations in urban streams in arid Study Units are likely from naturally occurring salts concentrated by the evaporation of surface water (Hem, 1992).

Whereas de-icers are applied to roads in other Study Units throughout the Nation, concentrations in streams and ground water in this Study Unit are likely greater for several reasons. The amount of snowfall and seasonal duration of subfreezing temperatures may be greater in the Study Unit than most other Study Units. De-icing compounds other than sodium chloride may be used in other Study Units.

Many streams had median chloride concentrations which exceeded the aquatic-life criteria established by the U.S. Environmental Protection Agency (1999). Elevated chloride concentrations in streams may affect biological communities by altering the species composition. Urban streams in the Study Unit were dominated by fish and invertebrate species that are tolerant to degraded physical and chemical conditions, compared to other streams in the Study Unit.

This figure taken from: **Stark, J.R., Hanson, P. E., Goldstein, R.M., Fallon, J.D., Fong, A.L., Lee, K.E., Kroening, S.E., and Andrews, W.J.,** 2001, Water quality in the Upper Mississippi River Basin, Minnesota and Wisconsin, South Dakota, Iowa, and North Dakota, 1995-98: U.S. Geological Survey Summary Circular 1211, 35 p.