

The Distribution of Deicing Chemicals in Ground Water and Surface Water in Glaciated Parts of the United States

By John R. Mullaney, U.S. Geological Survey, East Hartford Connecticut

Abstract

The use of sodium chloride as a deicing chemical on paved areas has increased dramatically in the northern United States since the 1950's. Sales of sodium chloride for highway deicing have increased from 591,000 tons in 1950 to more than 19 million tons in 2003. Concern has been growing about the effects of deicing chemicals on ground-water and surface-water supplies and aquatic habitats.

A study of the effects of sodium chloride input on ground-water and surface-water quality was initiated in 2004 by the U.S. Geological Survey through the National Water Quality Assessment (NAWQA) program. Data collected from 1993-2003 from shallow ground-water networks and surface-water basins in urban and forested settings in glaciated parts of the northern United States were studied to determine ancillary factors related to chloride concentrations, changes to water quality caused by sodium input, and whether export from selected basins was dominated by overland runoff or ground-water discharge.

Based on preliminary results, factors that are significant for predicting chloride concentrations in shallow ground water include recharge rates, soil type, population density, median age of housing, and the presence of septic systems. Factors that were significant in predicting maximum chloride concentrations in surface water include road density, average April precipitation, potential evapotranspiration, and the percentage of total runoff from overland flow.

Typical chloride concentrations in ground water and surface water in selected forested areas in the study area are less than 10 mg/L. The maximum concentration of chloride in shallow ground water underlying urban areas was 800 mg/L and the median was 46 mg/L. Chloride concentrations were as large as 4,300 mg/L in surface water in 20 selected urbanized basins averaging 27 square miles. The median of the maximum concentrations in samples from the 20 basins was 145 mg/L.

Yields of chloride, estimated from concentration and flow data from the selected surface-water basins were typically less than 10 tons per square mile per year in forested basins and greater than 50 tons per square mile per year from urban basins.

Biographical Sketches

John R. Mullaney is a hydrologist for the U.S. Geological Survey Connecticut District. He has a B.S. from the University of Connecticut (1986, Geology).

John has worked on a variety of projects relating land use to water quality, and other water resources issues including: the National Water Quality Assessment Program (Connecticut, Housatonic and Thames River basins), analysis of nitrogen loading to Long Island Sound, ground-water/surface-water interactions and nutrient loading from ground water, Superfund site regional assessments, residential ground-water use and availability, glacial aquifer mapping in northern New England.