Minnesota Pollution Control Agency

Environmental Outcomes Division

Ground Water Monitoring & Assessment Program

Sodium and Potassium in Minnesota's Ground Water

May 1999

What are sodium and potassium?

Sodium and potassium are chemicals commonly found in soils and rocks. They belong to a group of chemicals called the "alkali earth metals." (Lithium, cesium and rubidium are also alkali earth metals, but they are not discussed in this fact sheet because they were not frequently detected in ground water.) Sodium and potassium are often associated with chloride and bromide. In these forms, they readily dissolve in water. In soils containing appreciable amounts of clay, these metals are not mobile. Sodium and potassium are released slowly upon dissolution of rocks. Consequently, concentrations increase as residence time in ground water increases.

What are sources of sodium and potassium in ground water?

Potassium, an important fertilizer, is strongly held by clay particles in soil. Therefore, leaching of potassium through the soil profile and into ground water is important only on coarse-textured soils. Potassium is common in many rocks. Many of these rocks are relatively soluble and potassium concentrations in ground water increase with time. Important anthropogenic sources of sodium include road salt and animal wastes. Sodium is more mobile in soil than potassium and so it is used often as an indicator of human impacts to shallow ground water. Sodium is also a common chemical in minerals. Like potassium, sodium is gradually released from rocks. Concentrations therefore increase with time.

What are considered safe levels of sodium and potassium in ground water?

There are no health-based drinking water standards for sodium and potassium. Neither has a secondary drinking standard. Sodium intake may lead to hypertension and be a concern for people with heart conditions.

How are sodium and potassium distributed in Minnesota ground water?

Because there are anthropogenic sources of potassium and sodium, and because concentrations increase with residence time in ground water, concentrations may be elevated in shallow ground water as well as deep aquifers. Median concentrations of sodium and potassium from the Ground Water Monitoring and Assessment Program (GWMAP) statewide baseline network of 954 wells were 9.4 and 2.4 mg/L (parts per

million), respectively. Sodium, in particular, was unevenly distributed in ground water. Ninety-three samples exceeded a concentration of 100 mg/L. Concentrations of sodium were highest in the buried Quaternary, Galena and Precambrian aquifers and lowest in the Jordan and St. Peter aquifers. Concentrations were relatively low in surficial Quaternary aquifers. This contrasts with chloride, which also has anthropogenic sources and is found at relatively high concentrations in surficial Quaternary aquifers. Sodium is less mobile than chloride in soil. Potassium is more evenly distributed than sodium among aquifers. Median concentrations ranged from 0.99 mg/L in the Jordan Aquifer to 5.5 mg/L in Cretaceous aquifers. Concentrations of both chemicals increase from east to west in Minnesota. Differences in geology and increasing residence times are responsible for this distribution.

Which aquifers are most sensitive to contamination with sodium and potassium?

Since there are no drinking water standards for sodium or potassium, it is difficult to determine which aquifers might be sensitive to contamination. Surficial Quaternary aquifers do not appear to be impacted by human activity, although concentrations may locally be high due to anthropogenic sources such as animal waste, fertilizer and road salt. Deeper aquifers also have high concentrations resulting from dissolution of aquifer materials.

Why is it important to measure sodium and potassium concentrations in ground water?

Sodium and potassium are important ions in ground water and are used to assess quality control for samples and laboratory analysis. Like sulfate, sodium and potassium are often useful for identifying the source of ground water. This may be useful for programs such as Wellhead Protection. Sodium has some utility as a tracer of human and animal waste in shallow ground water.

What are some management strategies for reducing risks from sodium and potassium?

Distillation may reduce concentrations of sodium and potassium. Sodium may lead to hypertension. Ground waters with high concentrations of sodium and potassium are considered to be “soft” and therefore generally desirable for drinking.

Additional information, including reports and distribution maps, can be found on the Minnesota Pollution Control Agency’s Web site at ***http://www.pca.state.mn.us/water/groundwater/gwmap/index.html***.