MAINE TRACKS SALT TO ITS SOURCE

During winter months the state and local governments in the northeastern Snowbelt routinely use salt as a deicing agent to improve travel safety and mobility. As a result, runoff and snowmelt from highways may contain a concentration of sodium chloride that is higher than normal, with the potential to contaminate water supplies. Officials of the Maine Department of Transportation, the Maine Department of Environmental Protection, and municipalities in the state are frequently required to determine the source of saline groundwater and to assist property owners in identifying the best remedial alternatives. The remediation may occur at governmental expense if the cause of salinity is found to be road salt.

PROBLEM

Possible sources of salt contamination of water supplies in Maine include ancient seawater trapped in sediments approximately 12,000 years ago during the last continental deglaciation, intrusion of present-day seawater into aquifers along the coastline, and road salt or leachate from salt storage facilities. A means of distinguishing the various contaminant sources was necessary.

Well contamination by salt is a common problem in Maine. Governmental agencies have typically drilled new wells or provided municipal water to property owners whose water supply was presumed to be contaminated with road salt or salt stockpiles. The cost to taxpayers ranged from $10,000 to $20,000 per claim.

SOLUTION

The University of Maine conducted research for MDOT that allows differentiation of potable well water contaminated by road salt from that contaminated by natural processes. The researchers collected and analyzed samples from 66 water wells in Maine. Based on this investigation they determined that water chemistry has great potential for identifying sources of salt in groundwater. For example, bromide ion is abundant in both present-day and trapped seawater but it is generally not present in water contaminated with road salt. The presence of bromide ion indicates that seawater, not winter highway maintenance, is the cause of the salinity of well water.

The presence or absence of tritium, the radioactive isotope of hydrogen, can be used to distinguish trapped seawater from present-day seawater. The atmospheric concentration of tritium dramatically increased in the 1950s when the testing of thermonuclear devices started. Precipitation since 1950 contains elevated levels of tritium. Because this isotope decays with a half-life of 12.43 years, aquifers recharged before 1950 contain virtually no tritium.

It can be concluded that well water containing tritium but no bromide was likely contaminated by road salt; if both bromide and tritium are present, then the intrusion of present-day seawater is responsible. The presence of bromide but no tritium indicates contamination by trapped seawater.

APPLICATION

Since the completion of the research, detailed chemical analyses of water samples from contested wells in different areas of Maine have been conducted. In many cases road salt was clearly the cause of contamination. Steps were taken in these locations to redirect runoff or eliminate the source of salinity entirely by constructing enclosures for salt-sand stockpiles. In some cases the source of contamination was not obvious. If bromide was found, the road-salt source was also tested for bromide. Road salt sometimes contains trace amounts of bromide if the salt originally precipitated and formed in a marine environment. If the well was located in an area known to have been subjected to marine submergence during a glacial retreat that caused a rise in the sea level, the water was tested for tritium. The purpose was to determine whether the salinity was caused by present-day seawater intrusion or trapped seawater.

In one recent case, water in a well showed elevated chloride levels throughout the year. MDOT observations showed that highway drainage was not entering the property on which the well was located. Also, a nearby tidal river was not found to be adequately saline to cause the observed levels of contamination of the well water. Chemical analyses of the well water indicated the presence

of bromide and the absence of tritium; trapped seawater was presumed to be the source of contamination and MDOT was not held responsible.

In another case, bromide was found in well water along with low levels of tritium. Intrusion of present-day seawater was identified as the cause for this contamination; again, MDOT was not held responsible.

BENEFITS

MDOT has investigated eight claims since the testing process was developed. One water sample is typically analyzed for each claim. The cost of analysis is $40 per sample, and testing is performed by outside laboratories. MDOT estimates conservatively that the ability to determine the cause of salinity in well water has saved the department $60,000 since 1989. Approximately $18,000 has been spent on both the research and investigation of the eight claims. According to MDOT, the potential for future savings for the agency and for local governments through the use of this process is great.

For further information, contact Christine Olson, manager, Water Resources and Hazardous Waste, Office of Environmental Services, Maine Department of Transportation, 16 State House Station, Augusta, Maine 04333-0016 (telephone 207-287-5735).

HELP DOCUMENT THE BENEFITS OF RESEARCH
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Guidelines

Research Pays Off articles should be between 750 and 1,000 words. The title should be short, descriptive, and capture the reader's attention. Each article should include sections labeled **Problem, Research,** and **Benefits,** and should include the name, address, and telephone number of a contact person.

The **Problem** section should provide a description of the transportation-related problem in one or two introductory paragraphs (100—150 words). The **Research** section should describe the research objectives, scope, tasks performed, and findings, along with actions taken to implement the findings (450—600 words). The **Benefits** section should provide a summary of actual or expected benefits from this research, or innovative approaches for the transportation agency or public in-economic, social, or environmental terms, such as monetary savings, reduced fatalities and injuries, reduced pollutant emissions, and enhanced productivity or performance (200—250 words).

Authors should submit one or two illustrations (photographs, charts, or tables) that may help readers better understand the article. Proposed articles are reviewed by members of the Transportation Research Board Task Force on Research Pays Off. The Task Force includes G.P.Jayaprakash, chair; Christina S. Casgar; Amir N. Hanna; Frank N. Lisle; Stephen F. Maher; Joseph R. Morris; Scott A. Sabol; Peter L. Shaw; and K. Thirumalai.

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