**Article 139**

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# Rating Deicing Agents: Road Salt Stands Firm

Watershed managers frequently wonder if there are any practical alternatives to the use of road salt for keeping roads free of ice in the winter. Others are concerned about the impact of chlorides on downstream water quality or on adjacent plants. A Michigan study suggests that despite the development of alternatives, road salt (primarily sodium chloride, NaCl) generally remains a competitive choice based on environmental, infrastructural, and cost factors.

Most northern states have traditionally employed road salt as a primary chemical deicer (Table 1) and sand as an abrasive (for better traction). Although sodium chloride is an inexpensive and effective choice, concerns are frequently raised about its potential negative impacts—particularly from chloride—on human health, the environment, highway infrastructure, and vehicles (see Table 2). Alternate deicing agents are not free of controversy either. For example, some localities employ urea to protect critical infrastructure (such as bridges or airports) from corrosion due to chlorides. Application of urea, however, may increase nutrient loading of waterways. In an era of ever-decreasing budgets, cost is an important factor that will often determine the type of deicer to be used. Lastly, and most importantly, highway departments must be confident that a given deicing agent will provide safe roads in winter driving conditions.

To respond to these concerns, the Michigan Department of Transportation (MDOT) analyzed the comparative performance, environmental impacts, and costs of six deicing agents: road salt (sodium chloride, the most common deicer in Michigan); calcium magnesium acetate (CMA); CMS-B (also known as Motech, a patented product containing primarily potassium chloride and derived as a by-product of beet processing); CG-90 Surface Saver (a patented corrosion-inhibiting salt); calcium chloride; and Verglimit (a patented concrete road surface containing calcium chloride pellets). Sand was also included in the evaluation. The primary components of the selected deicing agents were also compared (Table 3). In addition, MDOT briefly evaluated ethylene glycol, urea, and methanol. Due to their poor performance, environmental and human health effects, or high cost, these three agents were dropped from consideration as practical deicing alternatives.

As might be expected, each deicer has a different combination of performance, costs, and impacts. This suggests that different deicers may be appropriate for different climatic regimes in the country. None of the seven deicers was considered to possess widespread adverse environmental threats; however, they can exert site-specific impacts depending on the deicing agent's runoff concentration. Impacts may be significant for many threatened and endangered species which are already stressed and habitat-limited, small streams and lakes, water supplies, and wetlands and swales. A comparison of the potential impacts of the seven deicing agents (Table 4) can help users choose the deicer(s) most suitable for a particular area.

**Table 1: Typical Elemental Composition of Two Road salt Samples (Biesboer and Jacobson, 1994)**

| Element | Concentration (ppm) |
|---|---|
| Sodium (Na) | 349,714.0 |
| Chlorine (Cl) | 539,259.0 |
| Calcium (Ca) | 4,573.5 |
| Potassium (K) | 187.5 |
| Iron (Fe) | 73.9 |
| Magnesium (Mg) | 55.7 |
| Aluminum (Al) | 27.7 |
| Lead (Pb) | 6.7 |
| Phosphorus (P) | 4.6 |
| Manganese (Mn) | 3.1 |
| Copper (Cu) | 2.0 |
| Zinc (Zn) | 1.9 |
| Nickel (Ni) | 1.7 |
| Chromium (Cr) | 1.1 |
| Cadmium (Cd) | 0.4 |

Note: concentrations are typically diluted by one to three orders of magnitude in urban stormwater and streams. Elemental nitrogen was not analyzed.