Environmental Impact of Deicers on Waterways and Vegetation

Contents

SUMMARY

Deicing is a critical part of a winter maintenance program. When it comes to the environmental impact of deicers, two common concerns arise: impact to waterways and vegetation. Both are related to the chloride levels introduced into the environment by deicers.

Sodium chloride, calcium chloride, and magnesium chloride are the most common deicers, and they all contain chloride. Chlorides also occur commonly in nature. In their natural amounts they do not pose a threat to the environment. As with many things, chlorides can be tolerated in moderation, but excessively high concentrations of chlorides may cause issues in waterways and in plant life.

Chloride ions are readily soluble in water, meaning chloride ions can easily be transported through the environment, migrating through soil to waterways and plants. High chloride levels in plants can cause problems like those from dry soil, though some species tolerate chlorides better than others. Once in the water system, chlorides are difficult to remove and may cause negative effects on aquatic life.

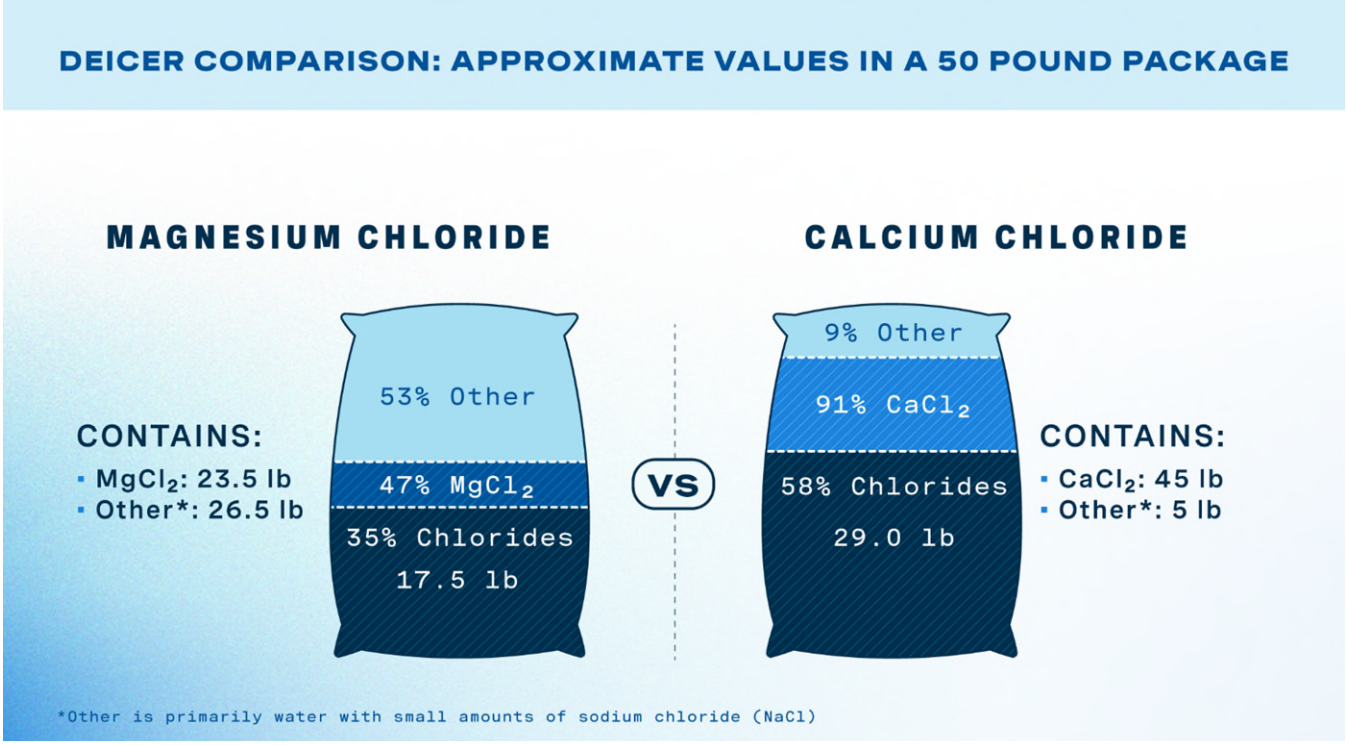
All these impacts are related to the amount of chlorides introduced into the environment. One of the best ways to protect the environment is to reduce the amount of deicer applied without compromising performance.

OxyChem®

KNOW APPLICATION RATES; KNOW THE IMPACTS

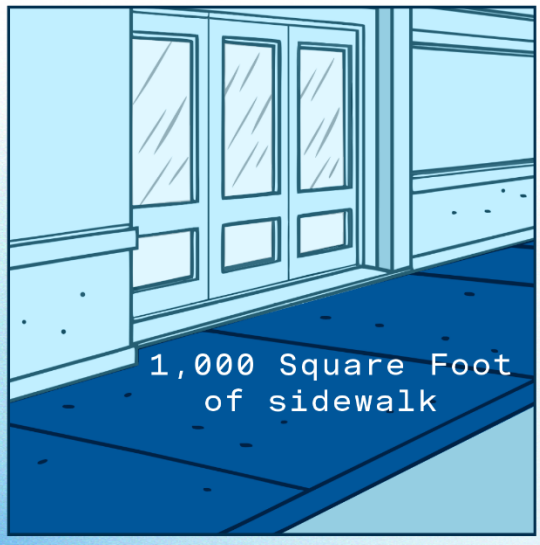
Many deicers claim to be “safer for the environment” or “environmentally friendly.” Don’t be misled by these statements: the key to a deicer being safer for the environment ultimately depends on how it is used, and what it is being compared against.

Take this example: magnesium chloride has less chlorides per pound of deicer, mostly because magnesium chloride is, at most, 47% active ingredient.



However, since magnesium chloride is not as effective at melting ice as calcium chloride, you must apply more to melt the same amount of ice. For example, if you have a 1,000 square foot walkway, and its 20°F, you should apply calcium chloride at the recommended application rate of 28 lb/1,000 ft2. This is equal to 16.4 pounds of chlorides. However, to melt the same 1000 square foot walkway, you need to apply 50 pounds of magnesium chloride. Since more magnesium chloride is required to do the job, you’re now applying 17.5 pounds of chlorides (almost a full pound more!) than if you applied calcium chloride.

APPLICATION RATE



YOU COULD APPLY

• $CaCl_2$	28 lbs
• $MgCl_2$	50 lbs

WHICH MEANS

• $CaCl_2$	16.4 lbs of chlorides are put in the ground
• $MgCl_2$	17.5 lbs of chlorides are put on the ground

By using calcium chloride at the proper application rate, less chlorides are introduced!

The Importance of Application Rate

As shown above, to minimize the introduction of chlorides into the environment, OxyChem, in addition to many researchers and government agencies, emphasizes the importance of applying less deicer. Using less deicer starts with using correct application rates and best practices. Use only enough deicer to break the bond between the ice and the pavement. Once this bond is broken, remove the remaining ice, snow, or slush with a shovel or other device. It is a sign of over-application when significant quantities of solid deicer remain on a surface that is free of snow and ice.

HOW DO CHLORIDES FROM DEICING IMPACT THE ENVIRONMENT?

Chlorides and Water

The effect of deicer runoff on surface water and groundwater has been the focus of a great deal of research by government agencies and academics. Chlorides from deicer application in runoff can elevate chloride concentrations in water bodies. The primary concern is the potential degradation of groundwater, which may be used for drinking water supplies, and surface waters, potentially affecting aquatic life. An influx of chlorides is thought to affect dissolved oxygen (DO) availability in surface waters, affecting aquatic life. Reduced oxygen may also cause increased algae growth, further depleting the dissolved oxygen.[1] Elevated chlorides in groundwater may give drinking water a salty taste.

Chlorides and Turfgrass

Grass can be present directly adjacent to the deicing surface. A study in 1996, titled "The Effects of Deicing Chemicals on Turfgrass,"[2] by the Horticulture Department of Iowa State University, compared the effects of various deicers, including calcium chloride, magnesium chloride, and sodium chloride on Kentucky Bluegrass at typical application rates. After a winter season of deicer application, the study showed that calcium chloride was the least damaging to existing turf, and in fact was less damaging than magnesium chloride. Note, however, that if large quantities of deicer are applied directly to grass or vegetation, damage can occur regardless of deicer type used.

Chlorides and Vegetation

Chlorides are readily absorbed in water, and as the water moves through the soil, it can impact plants. When high levels of chlorides are in soil water, this can interfere with how a plant absorbs moisture from the soil. Plants absorb water from the soil through membranes in the roots. Based on chloride concentration on either side of this membrane, water will flow in the direction of the higher chloride concentration. Thus, a chloride-rich soil water will inhibit the water intake of the plant and can even draw moisture from the plant. The symptoms of excess chlorides look similar to those of dry soil. Excess chlorides can also affect plant tissues – by accumulating in plant leaves and causing discoloration, particularly in woody plants.

Similar to how different plant species tolerate different amounts of water, different plant species tolerate different amounts of chloride. For example, younger plants are more susceptible to chloride damage than aged plants, and grassy vegetation is generally more chloride tolerant than trees and woody plants. Several studies have developed lists showing the relative chloride tolerance of a variety of trees, shrubs, and grasses, see Table 1.

Table 1: Relative Chloride Tolerance of Trees, Shrubs, and Grasses[3,4]

Deciduous Trees		Deciduous Shrubs		Evergreen Trees & Shrubs		Grasses	
Common Plant Name	**Tolerance Level**	**Common Plant Name**	**Tolerance Level**	**Common Plant Name**	**Tolerance Level**	**Common Plant Name**	**Tolerance Level**
Thornless Honey Locust	High	Privet	High	Pfitzer Juniper	High	Kentucky 31 Fescue	High
Yellow Birch	Moderate	Honeysuckle	High	Creeping Juniper	High	Red Fescue	Moderate
Paper Birch	High	Forsythia	Moderate	Adam's Needle	High	Bromegrass	Moderate
White Birch	Moderate	Weigela	Moderate	White Pine	Low	Kentucky Blue Grass	Low
Red Maple	Low	Spirea	Low	Red Pine	Low		
Sugar Maple	Low to Moderate	Rose	Low	Jack Pine	High		
Redbud	Moderate			White Spruce	Moderate		
Green Ash	Low			Canadian Hemlock	Low		
White Ash	High			White Fir	Moderate		
Tulip Poplar	Low			Douglas Fir	Moderate		
White Oak	High						
Red Oak	Low						
Pin Oak	Low						
Bitternut Hickory	Moderate						
Shagbark Hickory	Moderate						
Quaking Aspen	High						
Red Elm	Low						
American Elm	Low						
Cottonwood	High						

[1] *Highway deicing, comparing salt and calcium magnesium acetate*, Special Report 235, Transportation Research Board, National Research Council, Washington D.C., 1991.
[2] *The Effects of Deicing Chemicals on Turfgrass*, D. Minner and B. Bingaman, Iowa State University, 1996.
[3] P.D. Kelsey and R.G. Hootman, "Deicing Salt Dispersion and Effect on Vegetation Along Highways," in *Deicing Chemicals and the Environment*, ed., F.M. D'Itri (Chelsea, Mich.: Lewis Press 1992);
[4] R.E. Hanes, *Effects of De-icing Salts on Water Quality and Biota* (Washington, D.C.: Transportation Research Board, National Research Council, 1976).

For more information regarding OxyChem's calcium chloride products, please visit our website at www.OxyCalciumChloride.com.