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How Road Salt Does More Harm Than Good

Analysis by Dr. Joseph Mercola ✔ Fact Checked | February 16, 2023

STORY AT-A-GLANCE

- In the U.S., 20 million tons of salt are used for highway deicing annually
- Chloride does not break down in water, so once it enters waterways and groundwater it becomes a "permanent pollutant," putting freshwater ecosystems at risk
- Chloride concentrations related to road salt increased in 84% of U.S. streams tested
- Freshwater ecosystems are becoming salinated, leading to decreased biodiversity of aquatic animals and plants
- In Minnesota's Twin Cities metro area, 27% of wells monitored in the area's shallow aquifers had chloride levels that exceeded the EPA drinking water guidelines
- Using best management practices, such as proper storage, anti-icing, pre-wetting and storm-specific applications may help reduce road salt usage

Sodium Chloride (NaCl), also known as table salt or rock salt, is the most common compound used for deicing roads and highways in the U.S.[1] While it's extremely effective at melting snow and ice, the 20 million tons of salt used for highway deicing annually[2] in the U.S. doesn't stay put on the roads.

Road salt that runs off roadways is contaminating waterways and groundwater at an alarming rate. It's also highly corrosive, leading to an estimated $5 billion in repairs to U.S. bridges, roads and other infrastructure each year.[3]

The environmental damage has become so great that many are calling for reductions in road salt usage or for the practice to end altogether, but this would require massive, voluntary change. Writing in Circle of Blue, journalist Brett Walton explained:[4]

> *"The best way to deal with salt pollution is to bar it entry — not to allow it in the water in the first place. By and large, that outcome will rely on the widespread and voluntary adoption of salt-reducing practices by road agencies, shopping mall owners, apartment complex managers, and homeowners.*
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> *Reducing salt use also hinges on societal shifts: public acceptance in urban areas of slower winter driving speeds and less driving in hazardous weather."*

'A Permanent Water Pollutant'

Part of what makes road salt such a pernicious pollutant is that there's little that can be done to remove it. Chloride does not break down or "settle," so the only way to get it out of water is to ensure it doesn't end up there in the first place.[5]

"You can think of chloride as a permanent pollutant in the water," said Christe Alwin of the Michigan Department of Environment, Great Lakes, and Energy, told Circle of Blue. "Once it's there, there's very little opportunity to treat it."[6] The majority of salt applied to roadways appears to be settling in freshwater lakes, streams and groundwater.

For instance, a study by University of Minnesota researchers revealed that 78% of salt applied in the Twin Cities during the winter ends up in groundwater, lakes or wetlands.[7]

As a result, freshwater ecosystems are becoming salinated at levels that put biodiversity and even drinking water at risk. It's a widespread issue, since 70% of the U.S. population lives in areas impacted by snow and ice. Deicing roadways with salt has been found to reduce vehicle accidents in these regions by more than 78%.[8]

However, it takes just one teaspoon of salt to pollute five gallons of water,[9] and safe thresholds for freshwater are "commonly surpassed."[10] According to the Missouri Department of Natural Resources:[11]

"Chloride occurs naturally in lakes and streams, and many organisms need it to carry out the basic functions of life. But elevated levels can cause cells to lose water and become deprived of nutrients, ultimately killing fish, amphibians, plants and other aquatic organisms. On land, excessive amounts of chloride can harm pets, soil, cars, bridges and more.

Although scientists have known about the potential for chloride to cause problems in the environment since at least the 1960s, it wasn't until recently that researchers began to learn the true extent of the problem."

Writing in The Science of the Total Environment, a review by University of Lodz, Poland, researchers not only identified high concentrations of chloride in groundwater and surface water but also found that it led to concerning effects on freshwater ecosystems, including:[12]

Decreased biodiversity of aquatic animals and plants	Increase in the growth of phytoplankton, particularly cyanobacteria (blue-green algae)
Reduced self-purification processes	Decreased nutrient accumulation in macrophytes (aquatic plants)
Decreased denitrification rate	Reduced organic matter decomposition

Chloride Linked to Road Salt Increased in 84% of Streams

The U.S. Geological Survey (USGS) has been monitoring trends in chloride concentrations across the U.S. In one study that monitored 30 sites on 19 streams near cities in Wisconsin, Illinois, Colorado, Michigan, Ohio, Pennsylvania, Maryland, Texas and the District of Columbia, chloride concentrations related to road salt increased in 84% of them during the study period.[13] Similar findings have been revealed at the state and local level, Walton said.[14]

"Numerous streams in the study exceeded concentrations that are toxic to aquatic life," USGS noted, while 29% of the sites exceeded the U.S. Environmental Protection Agency's (EPA) chronic water quality criteria more than 100 days per year, on average.[15] Other studies have also raised red flags over the indiscriminate use of salt as a deicing agent.

One found that 37% of the drainage area of the contiguous U.S. has become increasingly salinated over the last 100 years.[16] Another study, involving private water wells in a southeastern New York township, found more than half the wells tested exceeded EPA health standards for sodium.[17]

In Michigan, meanwhile, the Department of Environment, Great Lakes, and Energy (EGLE) finally set a standard for chloride in water in 2019. In 2022, it found that eight stream sections exceeded the state's threshold for chronic exposure of 150 milligrams per liter.[18]

Road Salt Affecting Human Health and the Environment

While there are multiple sources of chloride in the environment, including water softeners and fertilizers, road salts are considered the major contributor.[19] It has wide-reaching implications for human health and the environment.

Due to widespread groundwater contamination, drinking water is at risk in many locations. In Minnesota's Twin Cities metro area, for instance, 27% of wells monitored in the area's shallow aquifers had chloride levels that exceeded the EPA drinking water guidelines.[20] Once in the water, fish, aquatic bugs, aquatic vegetation and amphibians may be harmed by even low levels of chloride.[21]

Plants and trees along roadsides are also harmed by road salt splash, while soil with too much salt loses its ability to retain water and store nutrients. Wildlife, including certain birds, can also be killed by deicing salt, while pets may become ill from licking it from their paws. Infrastructure is also damaged by chloride, which is corrosive to road surfaces, bridges and reinforcing rods.[22]

Road salts can also mobilize other toxic compounds, including radon, mercury and lead, leading to even more damage to drinking water and freshwater environments.[23]

"Salt is something of a ticking time bomb for freshwater," said former Riverkeeper president and director of the Resilient Coastal Communities Program at the Center for Sustainable Urban Development, Paul Gallay. "Studies suggest that the increasing concentrations we see in many places may be the result of road salt spread decades ago, which reached groundwater, and is only now slowly reaching surface waters."[24]

What Are the Alternatives to Road Salt?

Magnesium chloride and potassium chloride are two alternatives to sodium chloride, but they pose many of the same risks, since they're also chloride-based.[25] Calcium magnesium acetate is another option, but it's about 40 times more expensive than sodium chloride.[26]

Some areas, including the Missouri Department of Transportation, are also adding beet juice to road salt to lessen its corrosive properties and treat roadways more effectively at lower temperatures.[27] Most available alternatives, however, may cause problems of their own, according to University of Toledo researchers.[28]

> *"Although there are rock salt alternatives, such as potassium- and calcium-magnesium acetate, agricultural byproducts (e.g., beet juice), and abrasives (e.g., sand), these can trigger other problems, such as deposition in freshwater habitats (e.g., sand), introduction of nutrient subsidies, and changes in food webs. Alternatives to chloride-based deicers can also be cost-prohibitive."*

Best Practices to Help Reduce Road Salt Usage

Research from The University of Toledo outlined several best management practices (BMPs) for the use of road salts, since "at present there are no ecologically friendly and few cost-effective alternatives to deicing salts." The options include:[29]

- **Proper storage —** Salt should be stored in "permanent, four-side structures with an impervious concrete base."
- **Anti-icing and pre-wetting —** Applying liquids, such as salt brines, to roadways before storms prevents ice from bonding to surfaces. This may reduce the amount of salt needed by 75%. Pre-wetting salts prior to application, it can reduce the amount of salt that leaves roadways by 26%.
- **Storm-specific applications —** Salt applications rates should be varied based on storm intensity and duration, pavement surface temperature and more. Equipment should also be calibrated to prevent overapplication. "Storm-specific strategies prevent salt overapplication and can reduce seasonal salt need by 50%, and may represent one of the most important BMPs," the study found.
- **Live-edge snowplows —** These reduce the need for road salt by making snow and ice removal more efficient.
- **Post-storm evaluations —** Assessments should be made after the storm to determine if the treatment was appropriate or needs to be modified in the future.

Not spreading salt when the pavement is too cold is also important, since salt generally does not help when applied to pavement below 15 degrees F. Making roads out of porous pavement is another option being explored, which allows water to seep through, helping to prevent ice formation on roads.

It's suggested that porous pavement could reduce the use of road salt by 77% annually. Engineering roadways out of solar panels with embedded hot water pipes is another possibility that would eliminate the need for road salt by melting ice and snow.[30]

In the meantime, you can help on an individual level by minimizing the salt you apply on your driveway and walkways. Shoveling early after a storm will reduce the need for salt.

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