



Life is About Choices and their Inherent Risks,
Here's One: De-Iced Roads or Drinkable Water

By Bruce K. Bernard, PhD

Salting roads, highways and walkways in winter helps prevent injury and save lives by reducing the risk of accidents on icy surfaces. As with everything in life, however, there is no “free lunch.” Everything has a downside; sometimes we have to look for it. As I told my son years ago, when something is “free” (i.e., has no cost), “WATCH OUT.” In this case, the use of salt, as an immediate safety measure on icy roads has a downside that is playing out over the long term. Applying salt on pavement raises the salinity of natural waters, leading to ecological and human health effects;¹ it also promotes pipe corrosion. In Flint, Michigan, for example, pipe corrosion from elevated chloride levels contributed to lead leaching into the water supply. And elevated sodium levels in drinking water can be harmful to dialysis patients.



*Salt unevenly applied in a Maryland parking lot
in winter, 2017*

Salinity in the Northeastern US

Salinity is the total of all non-carbonate salts dissolved in water. Because many dissolved solids are chlorides, including sodium chloride and calcium chloride, the chloride concentration of fresh water is an indicator of salinity. To put things in perspective, most natural fresh water contains nearly zero salinity, whereas ocean water averages about 35,000 milligrams per liter (mg/L).² Contrast that to chloride concentrations in some rural streams in New England's White Mountains that can exceed 100 mg/L. These White Mountain levels are similar to levels found in estuaries where ocean water mixes with fresh water (commonly called a salt front). The Chesapeake Bay and the Hudson River are prime examples of an estuary. The salt levels in the White Mountains are in fact similar to levels found in the Hudson River estuary at its salt front. Researchers estimate many rural streams could reach a salinity of 250 mg/L in the next century, a level at which stream water will be “toxic to sensitive freshwater life and not potable for human consumption.”³

Salinity Builds over Time

¹ Kaushal, S.S., Groffman, P.M., Likens, G.E., Belt, K.T., Stack, W.P., Kelly, V.R, Band, L.E., and Fisher, G.T. (2005). “Increased salinization of fresh water in the northeastern United States,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 102, no. 38, 13517-13520. On line, available: <http://www.pnas.org/content/102/38/13517.full>.

² [US National Oceanic and Atmospheric Administration](#)

³ Kaushal et al., *op. cit.*

The rising salinity of natural waters in the northeastern US is strongly correlated with an increase in the area of impervious⁴ surfaces resulting from development in the region. In other words, more highways, roads and parking lots translates to more salt applied in winter. Nevertheless, even rural areas with a low density of roadways in Maryland, New York and New Hampshire have elevated freshwater salinity levels, with the highest concentrations in winter. But the baseline salinity of streams “is now increasing at a regional scale in the northeastern United States toward thresholds beyond which significant changes in ecological communities and ecosystem functions can be expected.”⁵ Scientists R.B. Jackson and E.G. Jobbagy⁶ note that one reason for that is salt concentrations build up over many years and remain high in soil and groundwater. If groundwater is salty, they explain, streams will be salty from groundwater seeping into streams. It is groundwater that often keeps water flowing during dry periods, typically in summer. Groundwater salinity, they say, is “the primary concern for long-term potable water supply. Once groundwater becomes salty, it typically will take decades to centuries for the salts to disappear, even when road salt use ends.”

A Balancing Act

Public safety requires that we treat paved surfaces to help prevent accidents during ice and snow events. But are chloride salts the best option? Can chloride salts be used more judiciously and applied more efficiently? Here are some alternatives to applying dry “rock” salt:

- Applying LIQUID salt solutions or *brines* by pre-wetting surfaces with brines. This method is considered more effective and less expensive than applying dry salt and uses much less salt.⁷
- Mixing road salt with sand, sugar or beet juice (sugar and beet juice lower the melting point of ice, enhancing the performance of the salt).
- Replacing road salt with de-icer chemicals, such as highly biodegradable formic acid salts (formates).
- Using cheese brine or pickle brine, which lower the melting point of ice.

Once again, what seemed like a simple solution to an immediate problem, in this case icy roads, comes with initially unforeseen long term effects, contaminating our drinking water. As is said in the “Kung Fu” movies now popular in western societies, “...Balance grasshopper; balance not just for karate, balance for whole life...” Now that we are aware of the danger to our drinking water, we have a choice. Do we ignore the problem until it becomes a threat to our existence, or do we do something now to prevent it from becoming an existential disaster?

Life is about choices and their inherent risks...will we take on the challenge and fix it before it becomes a problem or will we ignore it and create another problem for our grandchildren?

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⁴ According to Wikipedia, “Impervious surfaces are mainly artificial structures—such as pavements (roads, sidewalks, driveways and parking lots) that are covered by impenetrable materials such as asphalt, concrete, brick, stone—and rooftops. Soils compacted by urban development are also highly impervious.” https://en.wikipedia.org/wiki/Impervious_surface

⁵ Kaushal et al., *op. cit.*

⁶ Jackson, R.B. and Jobbagy, E.G. (2005). “From icy roads to salty streams,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 102, no. 41, 14487-14488. On line, available: <http://www.pnas.org/content/102/41/14487.full>

⁷ Erin Cassidy, “Rock salt versus salt brines: What’s best for road safety?”, January 12, 2017. On line, available:

<http://www.accuweather.com/en/weather-news/rock-salt-vs-salt-brines-whats/22352942>