Road Salt

The accuracy of this section will depend intensely on region. It should apply fairly well to regions with cold, snowy winters, where roads are currently kept clear of ice using salt. Not all snowy areas rely on salt, even within in the United States which is generally over-reliant on it. It's as much a matter of ingrained defaults and expectations as cost and safety.

Most of my original notes and references were US-centric, especially for the nature of the problem.

What is road salt and why do we use it?

In cold regions, before and during snow and ice storms, salt is applied to parking lots, sidewalks, and driveways to melt ice and and prevent its buildup, in order to protect the safety of drivers and pedestrians. This work is performed by a mix of government employees (often from state Departments of Transportation) and contractors, private operators, city employees, and private citizens. The plow trucks they use to clear the roads of snow are equipped with salt spreaders which fling sand and salt onto the roads behind them to melt the ice, but this is a widespread practice; smaller city snowblowers operate in a similar fashion, and even individuals shovel salt from buckets onto their driveways, sidewalks, stairs, and footpaths. This practice, carried out annually for decades has poisoned numerous waterways, and thousands of acres of roadside land.

Road salt works by lowering the freezing point of water, making ice melt even when the temperature is below water's normal freezing point of 32 degrees. When salt contacts and dissolves in water, it breaks into two ions, sodium and chloride, which interfere with water molecules' ability to bond together and form ice.

Road salt use is common and growing throughout Canada, Europe, Japan, China and South America. Salt was first used to deice roads in the U.S. in New Hampshire in 1938. It proved to be cheap and effective, and by the winter of 1941-1942, about 5,000 tons of salt were being spread on highways nationwide. In the following decades this use of salt as a deicer increased exponentially. As the population grew, so too did the number of vehicles and amount of impervious surfaces such as roads and parking lots receiving deicing treatment every storm. Today an estimated 20 million tons of salt is scattered on U.S. roads annually—about 123 pounds for every American. As much as 60 million metric tons (66 million tons) may be applied worldwide each year.

This annual relocation of millions of tons of salt have had a documented effect on the habitats its dumped into. Sodium chloride concentrations in freshwater have increased dramatically. This affects both surface streams, lakes, ponds etc, but also groundwater and aquifers.

The Damage

Concentrations of chloride in surface waters have risen steadily for decades, killing off large swaths of aquatic plants and animals, nearly sterilizing some rivers of life altogether. As with most environmental damage, this impact is and will continue to cascade. The steady die-off reduces the self-purification processes of water by decreasing nutrient accumulation in aquatic plants, decreasing the denitrification rate, and reducing organic matter decomposition. Ironically this allows for an overenrichment of nutrients in the water, which favors phytoplankton, especially cyanobacteria which can tolerate the new conditions, causing toxic algae blooms. These then cause even more damage to the aquatic habitat.

On top of that, chloride seeps into the groundwater, contaminating wells and aquifers. And though it isn't especially poisonous to humans on its own, high enough concentrations are caustic enough to damage pipes and leach lead into drinking water. And humans weren't the only ones affected: the salt which has vanished underground hides the extent of the problem – some of this pollution won't re-enter streams and lakes [[https://news.climate.columbia.edu/2018/12/11/road-salt-harms-environment/until decades after the salt hit the road]], meaning that the concentrations could continue to increase in surface waters independent of human activity.

Because the ions that make up road salt don't evaporate or break down, and plants don't significantly filter them out of the soil, road salt accumulates in the environment after it is applied. Road salt can also be detrimental to lakes in other ways. Water polluted by road salt is denser than freshwater and therefore salt contaminated water will settle to the deepest part of the lake where it can accumulate. This chemical stratification, or the development of layers of water due to density differences, can prevent the natural mixing of lakes, which in turn can lead to a near permanent layer in the lake's bottom waters. Often that bottom layer becomes devoid of oxygen and is unable to support aquatic insects and fish life. https://www.canr.msu.edu/news/salt_runoff_can_impair_lakes

Once salt is in the environment, it is nearly impossible to take it out. Costs of chloride clean ups can run around $300,000,000, a cost that is estimated at 30-40% higher than efforts to protect drinking water in the first place https://saltresponsibly.com/the-problem-with-road-salt/

Salt also damages everything from shopping carts (that's why they are now coated) to concrete and infrastructure, causing rust and corrosion over time.

Solutions

At this point the damage is well documented, and numerous organizations have started to recognize the damage road salt is causing and are pushing for change. For example, the NH DOT began studying alternatives in 2011 and retraining not just their own drivers but also city, town, and private operators by offering liability incentives to those who attend their course.

Permeable paved surfaces

Use less. More salt does not equate with more melting. Remove snow and ice manually. The more you remove, the less salt will need to be applied. Sweep up any excess salt visible on a dry sidewalk. Do not apply salt below 15°F – most salt products will not work below that temperature. Calibrate your equipment Use stream nozzles for anti-ice brine, not fan nozzles Do not apply anti-ice brine to pavement with snow or ice Use pavement temperature, not air temperature, to determine which deicer product to use Do not apply road salt when pavement temperatures are below 15°F

Solarpunk Alternatives

There are several ways to provide traction and remove salt without pouring salt over every paved surface in society every winter storm. The downside is that within the system we currently operate, they're generally worse.

Depending on weather conditions and temperature, their crews may switch to different mixes of Salt (NaCl) or a Salt Brine, coarse “winter” sand, Calcium Chloride (CaCl), Liquid Magnesium Chloride (MgCl2), or a Liquid Chloride Blend. These new techniques reduce the total amount of salt needed to do the same job, and they eventually supplemented with alternatives such as beet juice, molasses, and agricultural byproducts like grape skin compounds which reduced it further.

rely primarily on sand, sugar (though this can also cause environmental problems) and the occasional brine when they need ice removed immediately. The big difference is in the number of autoroads and bike paths maintained to bare-pavement conditions, especially during winter storms.

The simplest solution requires some of the biggest changes: if a solarpunk society can move at a slower pace, accept a snow day or two during and after bad weather, much of the excess labor and resources necessary to keep roads clear and driveable even during severe blizzards can be reduced. Even in winter, the weather changes frequently, and ice on pavement often melts or sublimates on its own once the sun is on it.

But this requires an entire cultural shift. In the present, many people are dependent on cars (and thus the road network) for everything from buying supplies to seeking emergency medical attention. When you need to get to the hospital, or when your job won't accept a raging blizzard as an excuse for being late, you need the roads to be clear because you have no choice but to drive on them. This constant rush means the natural world has to conform to our schedules - sidewalks can't be slippery for a day or even a few hours because people have to use them *right now*. Roads have to be clear at all times because there's no alternative, and opting out for safety isn't an option for far too many people.

This might be different in a solarpunk setting where the pace of life is hopefully gentler. An emphasis on trains and other public transit options (such as airships, ropeways, and trams) would mean that many people would have options besides driving. And an acceptance that weather exists and can derail our plans and schedules would mean that many of those who still rely on cars could safely wait for it to pass without losing their livelihoods. Fewer cars on the road mean fewer accidents and less risk for those who have to drive in bad conditions. In fact, the expectation that roads will take a few days to fully clear would likely inform peoples' decisions on where to live and how to prepare themselves. Rural areas often expected to be isolated during winter storms, and people often adapted their personal vehicles to meet the conditions.

This might even extend to accepting that not all roads even have to be plowed, and might be seasonal, open for regular use during summer and fall, and restricted to winter vehicles (such as snowmobiles, including a variety of ski-and-tracked truck-format vehicles), skiers, snowshoe-rs, etc during the winter.

In cities, people would need to accept that they can be safe in the winter without salt crunching underfoot. This is a fairly new cultural shift, but it's still driven by the need to hustle, even in bad weather, and legal liability.