Winooski Natural Resources Conservation District
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The Impacts of Road Salt to Our Waterways, Soils, and Infrastructure.

Living in Vermont, we depend on clear roads during winter to maintain our way of life. Organizations, agencies and municipalities throughout Vermont understand that there is an impact to the environment from road salt application practices. We must find the balance that protects the environment and still allows for safe roads.

Road salt (sodium chloride) was first utilized within the U.S. on roads in NH in 1938. By 1941 a total of 5,000 tons of salt were applied to highways nationwide. Today, between 10-20 million tons of salt are applied annually. This increase in road salt application is having a negative impact on our waterways, soils, cars, and infrastructure. Lake Champlain alone has seen a 30% increase in chloride levels within the past 10 years. Water quality monitoring has shown that some of the basins within Lake Champlain already exceed the sodium chloride levels that would impact those with hypertension and exceed levels that could potentially shift algae populations to those favoring toxic bloom causing cyanobacteria.

There are natural sources of sodium and chloride in the environment; however anthropogenic sources far exceed natural levels. In addition to road salt application, sodium chloride can make its way into the environment from wastewater treatment effluent, landfill leachate, chemical fertilizers, and salt storage, these are generally small contributions and localized.

Road salt lowers the freezing point of ice, allowing it to melt and prevents icy roads to a certain temperature. 15 degrees is regarded as the magic number, below that sodium chloride does not work. While sand costs less then salt, it has negative environmental impacts and is ineffective. Not only is sand easily blown away, it can cause sedimentation to local waterways and carries phosphorus. Road salt is 40% sodium, 60% chloride and may contain ferrocyanide for anti-caking and 5% of the total weight as phosphorus.

Road salt application within our waterways is generally measured in levels of chloride. Every body of water will differ as to what the background levels were historically and at what level the addition of road salt will have an impact. Road salt is applied to our many roadways, driveways, sidewalks, and parking lots. Following a thaw or rain event, the road salt is flushed into our waterways, lakes and road-side areas. Up to 63% of the road salt applied to roads can be transported by air into the surrounding environment. Studies have shown that between 10-55% of road salt makes its way into groundwater. Road salt accumulates in high concentrations in snow piles beside roads, or that has been plowed from roads. Road salt levels are highest in the spring, but have a lasting impact to groundwater which is shown in high sodium chloride readings within streams in the fall during low flow conditions.

Aquatic Impacts:

- A low nutrient body of water can experience impacts to algae (the base of the aquatic foodweb) at as little as between 2-10 mg/L , while other bodies of water with higher nutrient levels may not have an impact until levels reach 70+ mg/L.
- An increase in chloride levels will shift algae dominance from chlorophyte (green algae) to cyanobacteria (blue-green algae), which can lead to toxic algal blooms.
- Sensitive zooplankton species are impacted at 210 mg/l, which can cause a trophic cascade impact that can increase phytoplankton populations potentially causing toxic algal blooms,
- There is a shift in sensitive macroinvertebrate populations at 220 mg/l.
- Vermont chronic level of impact is 230 mg/l,
- The EPA standard not to exceed 250 mg/l,
- And Native brook trout populations are impacted at 250 mg/l,

Many streams within Vermont have already been identified as impacted by chloride through water quality monitoring efforts and exceed EPA standards and levels that would impact brook trout populations. For reference, some stream data collected in the summer, during low flow, sampled under the Chittenden County Stream Team:

- Indian Brook average 240 mg/l
- Engelsby Brook average 410 mg/l
- Pottash Brook average 430 mg/l
- Centennial Brook average 560 mg/l
- Sunnyside Brook average 630 mg/l

The addition of sodium chloride to waterways impacts the movement of metals, causing toxic accumulation. Chloride joins with metals (mercury, lead, copper) making them more water soluble and bioavailable.

The addition of sodium chloride to our waterways can release sediment bound heavy metals back into the water column. The density of the water can be altered, impacting how a lake turns over in the spring and fall causing anoxic or dead zones within the body of water. Under these conditions mercury, phosphorus and heavy metals can be released from the lake sediment. Normal stratification of lakes returns after the reduction in road salt loading.

Terrestrial Impacts:

- Soil bacteria near roadways are impacted at 90 mg/l.
- Impairment to seed germination takes place at 100 mg/l
- The sodium chloride will also strip the soils of calcium, magnesium and other important components needed for healthy soils. This can allow for invasive species to take hold.
- Road salt can cause drought conditions by limiting available water in soils and trees.
- It is not hard to find damage to trees along roadways. Sodium chloride burns the needles and leaves of species within 15 feet of roads and can impact sensitive plant species as far away as 650 feet.

- Road salt attracts wildlife to the road increasing the risk of animal related collisions.
- There have been many reported bird kills from eating the road salt within the U.S. and Canada.
- Sodium Chloride that enters wetlands and vernal pools can alter sex ratios of species of frogs and decrease the development of eggs thereby pushing already threatened species to the brink.

Infrastructure Impacts:

- In 2015 the U.S. National Highway Traffic Safety Administration noted salt corrosion as the cause of thousands of vehicle brake damage and failure. Sodium chloride can damage vehicles so bad they can have issues with steering, rust, and damage to any exposed metal, while technology is improving cars, the impacts from road salt can still be found. Estimates on vehicle depreciation due to de-icing salts is staggering, approximately $854 per car, per year in cold climates according to Transport Canada. Estimated at 11.7 Billion dollars per year nationwide.
- Our regions bridges, highways and infrastructure are heavily damaged by sodium chloride. It causes concrete to break and spread apart meaning costly fixes. In some areas this had led to the decreased lifespan of bridges and buildings impacting town and state maintenance budgets.
- Sodium chloride contaminates drinking water, damaging wells and pipes. In Flint, Mich. Road salt was a contributing factor to the lead poisoning as it corroded pipes allowing toxins to enter the drinking water. Within our homes and businesses, sodium chloride damages floors, baseboards and can be harmful to our pets and yards.

With all the known impacts, and still a need for safe driving conditions, what can we do?

A key strategy for addressing impacts from road salt to our soil and water health is the monitoring of sodium chloride levels within waterways and groundwater. In addition to the implementation of best management practices (BMP's) to reduce the application rates while maintaining a level of service expected.

Recommended Best Management Practices include:

- Anti-icing; apply product before or just as the storm starts. This prevents or weakens the bond of ice to pavement. By being proactive and not reactive, applicators are able to provide safer surfaces sooner, save money and protect the environment. Studies have shown it costs up to 6 times more to melt ice and snow from the top down then bottom up.
- Incorporate reduced salt application zones on roads near stream crossing, known vernal pools, wetlands and lakes.
- Apply product at the recommended vehicle speed, spreaders are most effective at 25 mph.
- Pre-wet or apply a salt-brine, this is a cost-effective anti-icing technique that sticks to the road surface.
- Utilize a Road Weather Information System (RWIS) linked to road temperature sensors and onboard monitoring software. By tracking application rates and current real-time weather, applicators can make adjustments and reduce waste.
- Insure all applicators (both public employees and private contractors) are trained in proper techniques, calibration and environmental risk assessment. States that have implemented successful

road salt reduction strategies have made private applicator certification mandatory through legislation.

- Assess chemical alternatives. Some contain higher levels of phosphorus and potentially can lower the dissolved oxygen within waterways causing anoxic conditions.
- Insure all applicators have written winter roads management plans that include level of service.
- Educate drivers to impact their behavior.

The reduction in application of road salt can be achieved without impacting the level of service provided, if Best Management Practices are followed. We all would like to see a reduction in costs to our towns and the state, thus a reduction in costs to the public and the increased protection of our natural resources.

All data, sources and information mentioned within this testimony can be found under the salt section of the Winooski Natural Resources Conservation District's website.

For more information on road salt reduction strategies and the Road Salt Reduction Initiative of the Winooski Natural Resources Conservation District, please visit: www.winooskinrcd.org

The WNRCD has been awarded two grants; one for research on BMP's to develop case-studies to document reduction strategies under the LaRosa Volunteer Water Quality Monitoring Analytical Services Partnerships Organizational Support Program and another under the Lake Champlain Basin Program Education and Outreach Initiative to create educational material and hold a workshop for road salt applicators within the Lake Champlain watershed. The District is working with state agencies, watershed groups, national organizations, public and private sector businesses and students to reduce the salting to our waterways.

The Winooski Natural Resources Conservation District is one of 14 conservation districts throughout Vermont. It encompasses all of Chittenden and Washington County as well as parts of Orange County (Orange, Williamstown and Washington). The district relies on grants and individual donations to complete conservation work. The WNRCD focuses its resources on completing conservation projects within the areas of agricultural assistance, forestland enhancement, urban conservation and watershed stewardship.

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