Environmental Geology – Dr. Warren Norton

TESTING ROAD SALT AS A SOLUTION

by Tampera Cleveland

When it Rains, It Pours is a popular slogan recognized in most American households. The slogan, which belongs to the Morton Salt Company, refers to ordinary table salt (sodium chloride).

Salt has been pouring on valuable usages since the dawn of time. Flavoring for food is but one example of the many important salt usages throughout history. Salt has been essential in agriculture as a fertilizer, in biblical times as a form of refrigeration, in ancient Roman culture as a form of payment—hence the term salary was born—(Reader’s Digest, June 1983, 82-85), in contemporary society as a water purifier, on the farm it’s fed to cows to encourage water intake and milk output, and in medicine it’s used to treat many kinds of manic-depressive illnesses (Manahan, 188).

Salt’s relevance in the world cannot be denied. Sodium chloride (Na\textsuperscript{+}C1\textsuperscript{-}) is one of the top five chemicals produced each year (Manahan, 170). One of the biggest usages for salt in the United States today is as a deicer for snow and ice on public and private roads across the cold regions of the country (Public Works, July 1988, 59).

Ohio is known for its snowfall and frigid temperatures during the winter season; therefore, identifying the methods of snow and ice removal is imperative in the Buckeye State. Many methods have been sampled, and so far none of them comes without consequence. I will touch on a few of the options in this paper, noting the best solution for our area.

As an effective deicer, road salt has long been utilized, but it, like most other things has its drawbacks. Recently, Canton, Ohio, came to realize that adding a mixture of liquid calcium chloride and water, together with sodium chloride, makes perhaps the best economically and environmentally benign deicer for the city and county (Monroe, City of Canton Public Works, Superintendent).

Before liquid calcium chloride, sodium chloride was the better deicer because it is easy to acquire, store, dispense, maintain, finance, and clean up. Road salt is inexpensively mined by (1) evaporating water from salt-rich inlands, or (2) from brines pumped from beneath the ground (Manahan, 188).
Most of Canton’s salt is mined near Lake Erie, housed in a gigantic Fairport, Ohio, storage facility, and supplied by the Mentor, Ohio, Salt Company. Tons of salt are transported by truck (as needed), and dumped or blown by a piler into salt domes. The blowing technique is the quicker, more efficient way of filling Canton’s three salt domes. The domes have a combined capacity of 4,700 tons and they are centrally located within the city limits on 9th and Schroyer Streets, S.W., and on 30th Street, NE, at the City Service Center. Unlike Portage County, Wisconsin (Public Works, July 1988, 58), Stark County does not have a salt storage problem. Canton has adequate manpower and dispenses its salt by using 21 of the 43 unit city street maintenance fleet. Each of the salt truck units has a reasonable life expectancy of about ten years, providing its dump body and chassis is maintained regularly with a coal tar sealer to prevent accelerated corrosion caused by salt. An annual budget of $350,000 per year was set aside to finance the city’s salt supply. At $35.50 per ton, the cost is minimal compared to the alternatives—sand, ash, and calcium magnesium acetate. The cost of substituting the alternatives would double, and sometimes even triple, annual budgets. Exorbitant clean up expenses are one of the major differences noticed when pricing the alternatives. Since the rain washes excess salt into the storm sewers, and it dissolves over time, road salt clean up is free (Monroe, City of Canton Public Works, Superintendent).

Escalating environmental concerns keep Cantonians wanting to be assured that the most viable solutions are being used to keep the streets cleared of ice and snow. One way the city accommodates its citizens is by adding a harmless blue tint to the salt so that the public can see the salt on the ground. This tint also helps to prevent the salt from clumping up. Being able to see their tax dollars at work evidently helps to ease the minds of citizens, because they don’t do much complaining to the city administration. Citizens are realistic, and they do recognize that road salt has its disadvantages. But by and large, the public consensus is that of toleration, as long as the adverse effects of salt’s use are kept low. Citizens acknowledge that the benefits of safety and environmental protection far outweigh the negative effects that salt sometimes produces (Bukoffsky, City of Canton Public Works, Technician).

One of the most common side effects of using road salt is the swift deterioration of untreated steel that it causes. To counteract this, cars have been made more corrosion resistant since the 1980’s. Auto rust and corrosion rates have been slowed down, but General Motors still advises its customers to keep as much salt as possible removed from the body and undercarriage of their cars (Working Mother, October 1994, 25). In Denver, Colorado, and Brooklyn Park, Minnesota, bridge deterioration is still a consistent and pervasive problem (Fisher, 28). To date, bridges are not a problem in Stark County (Monroe, City of Canton Public Works, Superintendent).
Damage and destruction of roads and small life forms—where straight sodium chloride is used—is inevitable, however. Excessive salt deposits eat away at concrete and tar leaving dangerous pot holes in city streets. Unless the gouges in the road are expediently filled in by the city, then the conditions could lead to unforeseen expenses for drivers. The chances of collisions, and damage to car frame and shocks are drastically increased as indirect results of road salt’s effects. Salt overspill usually causes damage to lakes, streams, and roadside vegetation. Sixteen percent of the city’s plants, fish, and invertebrates are maimed or killed as a direct result of concentrated salt levels (Fisher, 28). Bounce, infiltration and surface water run-off give way to these types of destruction. Since the 1960’s, we’ve known that using an innovative technique of pre-wetting salt can minimize or even alleviate some of the side effects that salt has (Public Works, July 1989, 52).

In 1996, the City of Canton started adding a 32% liquid calcium chloride and water mixture to the sodium chloride. The additional cost of doing this is only $0.45 per gallon, and the benefits far outweigh the cost (Monroe, City of Canton Public Works, Superintendent). Sodium chloride alone, is effective as a deicer only at temperatures which exceed 20 degrees Fahrenheit. Liquid calcium chloride works at sub-zero temperatures, reaching -30 degrees Fahrenheit. Less sodium chloride usage is required to do the same job, so money is saved. (Hamilton County in New York estimates saving $25,000 in material cost.) The pre-wetted liquid calcium chloride penetrates the ice and snow immediately, reducing bouncing of salt particles onto the shoulder or completely off the road. A kind of natural environmental cleanup is evident, as damage to bridges, lakes, streams, vegetation, and small life forms appears to subside (Public Works, July 1989, 53).

Liquid calcium chloride usage may help the city reduce its payroll expenditure in the future. Paying road crews can cause budgets to bulge. Therefore, city administrations try to keep a watchful eye out for the best ways to cut costs while preserving the environment. Snowfall this winter has not seemed unbearable, yet it was heavy enough (between January 1 and February 20, 1996) to have successfully eaten up $80,000 of a $140,000 allotted over-time budget. Paying road crews can become a problem, especially when we have a winter like this one, where the majority of our heavy snows just happened to "pile up" on the weekend. When this occurs, workers must be called into work on their days off at elevated pay rates. City street department workers are paid at the rate of time and one half for Saturday service, and at the rate of double time for work done on a Sunday. The total amount of over-time already spent this year confirms the fact that this winter's snow accumulation has been greater than last year's snow. Last year at this time, the city had only billed $27,000 to over-time cost. Providing snowfall is
Moderate next year, Canton may be able to reduce its annual Street Department Budget of $1.8 million.

Time and inflation influence budget cost, too. In 1988, the city's annual budget for road salt material was $220,000 as compared to a $350,000 budget in 1995 for basically the same amount of material (Monroe, City of Canton Public Works, Superintendent). Escalating cost often causes one to consider alternatives. Alternatives to using sodium chloride as a deicer are less effective, less economical, and more hazardous to the environment. Three popular alternatives to using road salt are sand, ash, and calcium magnesium acetate. Material costs for sand are significantly lower than salt—$3.89 versus $25 per ton. Spring cleanup cost, however, can be astronomical. Don Blood used sand for several years in Brooklyn Park: "One spring, I was out checking storm sewers. Thirty-eight inches of sand had accumulated in forty-two inch pipes. The cost of removing sand from the city's drainage system ranged from $125 to $600 per cubic yard" (Fisher, 33).

Canton, Ohio tried using ash back in the early 1920's because it was free to acquire. Ash does not melt snow, but it does provide for excellent "rubber to road" traction. However, ash is dirty, and according to Kevin Monroe, Canton, Ohio, Public Works Superintendent, "Ash is not a viable option for road deicing any more due to the adverse environmental impact that it causes." The long range cost of cleaning up the dirty ash reserves from storm sewer systems would drastically surpass the cost of using road salt. Ash is still occasionally used in some rural areas as close to Canton as Summit County (Bukoffsky, City of Canton Public Works, Technician).

Calcium magnesium acetate (CMA) was once thought to be a good salt substitute. It was viewed as a way to lower the high levels of salt reaching vegetation, lakes, streams, and drinking water. The drinking water in Cambridge, Massachusetts was causing its citizens to develop hypertension and heart disease. CMA was originally available in powder form and was difficult to apply. The salt substitute also did not adhere well to the road surface, especially in windy conditions. But the main reason why CMA is not used is because it would triple the normal cost to keep roads clear (Fisher, 30).

We have learned that salt, in its many forms has many valuable uses; from making our food taste more flavorful to making sure that we live to see another day. Keeping the roads cleared of ice and snow hazards while maintaining environmental consciousness is paramount in cold regions of American society. Until now, sodium chloride was the most conducive method of deicing for Stark County. 1960's science advanced the economic and environmental benefits of using sodium chloride by wetting it with a liquid calcium chloride and water mixture. The resourceful technology took
road salt to new heights of economic strength and public safety, thereby making it the best overall answer to the ice and snow problems for Canton, Ohio and Stark County.

Terms

Blue Tint - “Prussian Blue”; a tint or dye added to salt for visual effects and to prevent clumping; the blue color is synonymous with the Morton Salt Company.

Chassis - The rectangular steel frame, supported on springs and attached to the axles, that holds the body and motor of an automobile together.

Coal Tar Sealer - A “tar like” sealant that is painted or sprayed onto the underbody of vehicles to slow the rusting process.

Dump Body - the body of a heavy duty street maintenance truck; used to contain a substance.

Piler - a type of street maintenance equipment used to blow salt into salt domes vs. scooping and throwing it in; this equipment is designed to speed up the process and reduce spillage.
Works Cited


