

Proposal for Road Salt Additives



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I. Executive Summary

This project addresses the impacts that road salt has on people, the environment, and the costs it presents in the form of damaged infrastructure, loss of biodiversity, and decline in human health. Conventional road salt can be a cheap de-icing agent, but it can also cause more harm than good compared to other de-icing alternatives. The City of Oshkosh, like many northern communities, has been seeing rising chloride levels in drinking water from salt runoff in the winter months, which proves that there is enough salt being released into the environment to cause concern and look into less damaging options.

The damage to infrastructure such as pitting in concrete, corrosion of bridges, rebar, and drainage systems, and more plentiful potholes is estimated to be about \$10 worth of damage for every \$1 spent on salt to de-ice the roads. This estimate on damages comes from a report that Fortin Consulting prepared for the MN PCA in conjunction with the development of their Smart Salting training program. Salt also causes a variety of environmental impacts including leaf necrosis, which happens when salt spray on plants inhibits their ability to perform photosynthesis. The high salinity concentrations near roads cause some native species to die, making room for more salt-tolerant invasive species to move in and begin taking over. It is also toxic, even fatal, to birds who try to eat the salt grits to aid in their digestion, but end up getting hit by cars or have salt poisoning. The deer attracted to the salt on roads also causes a lot of traffic hazards. The salt runoff from the roads gets into waterways, increasing chloride levels up to 425ppm recorded in Sawyer Creek this past March which is considered “chronic aquatic life toxicity” by the DNR. This is concerning since the EPA’s recommended chloride level for drinking water is just 4 ppm (parts per million), or mg/L, but after a summer of not salting the levels were still at 71 ppm last October which is concerning.

The Salt Saver liquid brine from Green Earth Co. comes in 275 gallon totes which are \$2582.25 each, averaging out to about \$9.39 per gallon. Although this may seem costly upfront, this product melts ice so effectively that salt usage will be cut in half, saving the city \$100,000 to \$150,000 per year on salt. The Green Earth Co. is located in Fond Du Lac so shipping will only cost about \$75 per tote. Overall, we estimated that the city will still save about \$35,000 every year. The next option, Geomelt beet juice, costs about \$1,086.25 for a 275 gallon tote which cuts the amount of salt needed by 30%. Overall, after expensive shipping costs from the closest location in Illinois, we estimate the city would save about \$10,000 per year with this option. We discovered that the option of cheese brine would likely be free or fairly cheap from a local dairy operation, but the barrier to this is finding a cheese operation that has not switched to reusing the brine instead of disposing of it. It is also important to keep in mind that the beet juice and cheese brines can decrease oxygen in the water, but this would only be temporary.

This research hopes to gain enough support to take action by significantly reducing the amount of salt used as a de-icing agent by adding an organic or acetate additive to the salt already used. Both the organic additives (beet juice and cheese brine) and acetate additives (Salt Saver brine) make the salt stick to the roads better, melt the ice faster, and will work at lower temperatures than salt alone.

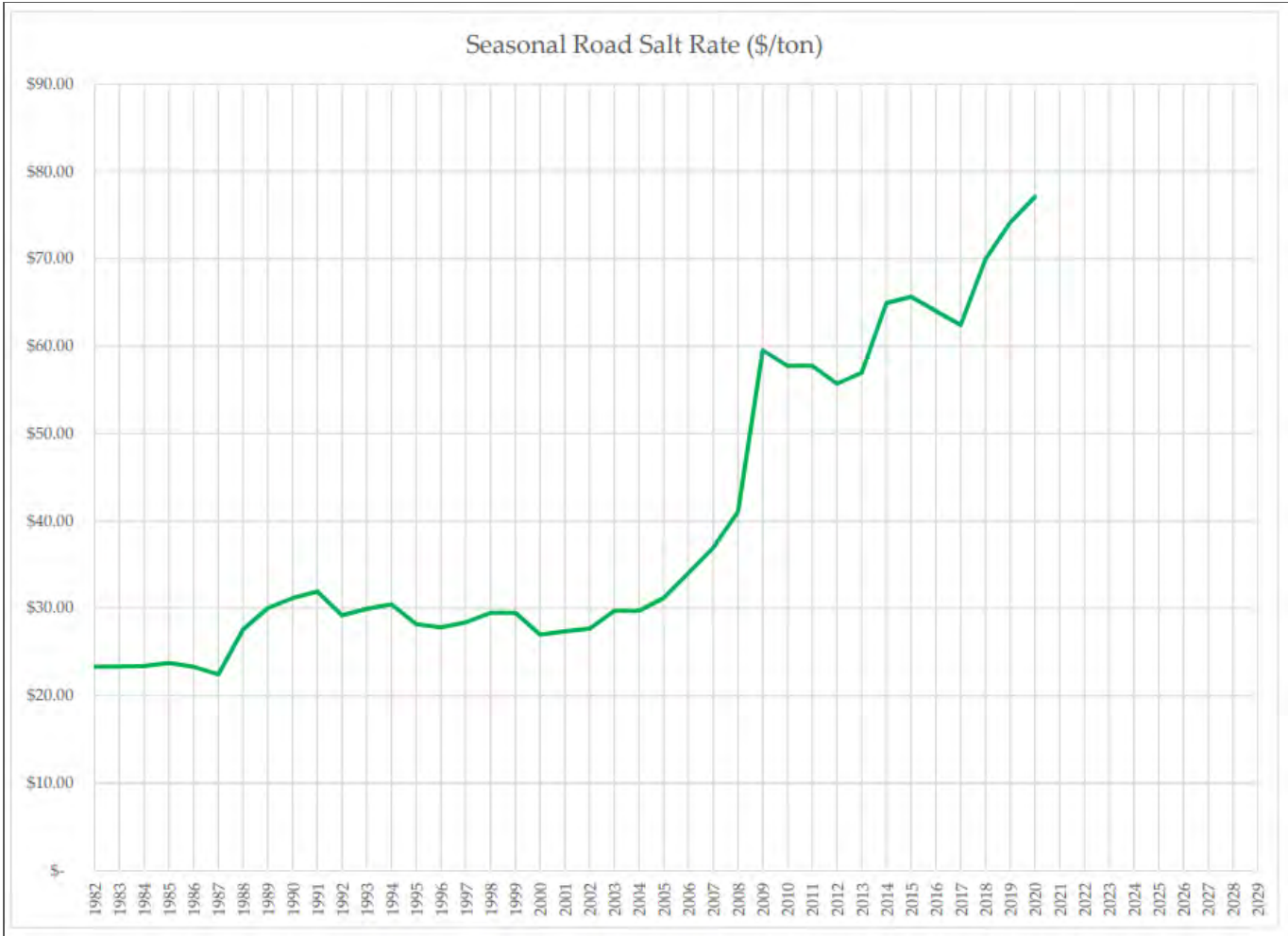
II. Background/Context/Problem Identification

The chloride levels in Oshkosh's waterways have been rising, even above the EPA and DNR's recommended limits in some areas. Although Oshkosh has been doing well so far monitoring the salt usage in winter and using brines, using another alternative to salt can help immensely with mitigating salt's impacts on the city's water quality, plants, animals, citizens, and infrastructure. Once the salinity of the water has a chance to diminish, aquatic species such as fish, tadpoles, fly larvae, and others can get their population levels, behaviors, and physical growth back to normal. However, there remains a concern for the native plants growing back when more salt-tolerant invasive species have already taken over their territory. This may require some restoration. Animal deaths on the roads should decline as well with less salt.

However, if this issue remains unaddressed, some terrestrial and aquatic species may be at more risk with continuing population and health declines. The runoff and spray will continue to kill plants on the roadsides and nearby ecosystems. The maintenance costs for potholes, bridges, and storm drains will remain high because of the corrosion salt causes. The water quality will also remain poor and cause possible health complications for citizens of Oshkosh. Public outreach on these issues should be a priority as well to ensure the citizens understand the importance of mitigating their own salt usage and using techniques such as sweeping up excess salt to reuse as Kelly Reyer (see Stakeholders) has been teaching the public about.

Another problem we look to address is the damage done from road salt to concrete roads/walkways and bridges, specifically spalling to the concrete, which is when the concrete will peel, pop out, or break off, and can be made worse when applied to new concrete (Anderson and Auster). This is caused when water gets trapped in the concrete, then goes through multiple freeze-thaw cycles, the thaw often caused by using salt on the surface. This can be made worse by having the damage deep enough to where the rebar in the concrete starts to corrode, weakening the concrete and shortening its lifespan, and needing to be replaced sooner than intended. Road salt can also be damaging to bridges, steel rebar, and the concrete on them. In a writing done by Dindorf and Fortin in Minnesota, they estimated that per ton of salt used, it costs about \$300 in bridge maintenance from salt in either spalling, or the scaling of concrete surfaces, or corrosion on the steel rebar.

Over the past 20 years, the cost of road salt per ton has been steadily increasing (see graph below which James Rabe provided). Oshkosh does not have one specific provider of salt for the city because they have multiple companies bid on the price until they get a winner. In the past winter of 2020/2021, the price per ton hit a new high for the city at \$77.10, and the price has risen significantly in 18 of the last 31 years. With the harsh winter Oshkosh had in 2018/2019, the city hit an overall total high of \$355,705, the price being well over \$100,000 in the last 15 years, and being over \$200,000 in 9 of the last 11 years. Even though Oshkosh still predominantly used dry salt on the road to get rid of ice, the city has started to use a salt and water mixture on their roads. In the year 2016, they moved away from driving to another city for their salt brine and invested in their own salt brine machine for \$63,768.



III. Recommended Action

We are recommending that the City of Oshkosh adds one of the following additives to salt in order to reduce the amount of salt used:

- A beet juice-based solution called Geomelt
- An environmentally friendly salt brine called Salt Saver
- A cheese brine

Reducing road salt use is the first step in addressing and repairing the environmental and infrastructural damage that it has caused. Using more sand as a supplement to road salt in its current deicing policy may also help. Additionally, we recommend that the city implement an educational campaign on the negative effects of road salt geared toward the general public. By providing educational materials, hosting an educational event (see Appendix E), increasing outreach via social media (particularly surrounding winter weather events), and involving the press in the positive efforts the city is pursuing, the citizens of Oshkosh could be motivated to do their part to reduce their own salt use, thereby reducing the use of salt throughout the city as well.

IV. Stakeholder Identification

A. Kelly Reyer (Outreach Coordinator at the Fox-Wolf Watershed Alliance)

Kelly Reyer, an Outreach Coordinator with the Fox-Wolf Watershed Alliance and alumni from the Environmental Studies program at the University of Wisconsin-Oshkosh, has been working with the Fox-Wolf Watershed Alliance for seven years to educate the public on water pollution/runoff issues in Wisconsin. Kelly is a primary stakeholder as a resident of Oshkosh where she is exposed to the road salt put on the city's roads in the winter. She also has valuable knowledge of the impacts of road salt in data collected from water sources.

Kelly believes that "monitoring needs to continue year-round and other efforts should be made such, as macroinvertebrate sampling to see if there are impacts to these freshwater species. Continued well monitoring is also important." Volunteers have been monitoring Sawyer Creek and Campbell Creek which flow into larger bodies of water. She has hosted Smart Salting workshops which the City of Oshkosh Public Works staff have attended. Kelly seemed very understanding of the fact that the Public Works departments have to try to find a balance between stakeholders who are concerned about the impacts of salt runoff on waterways, wildlife, and infrastructure, and other stakeholders who expect clear streets after snowstorms and lots of salt to be applied.

Overall, Kelly had really great input and perspectives on road salt. She seemed to think that Oshkosh was on the right track in trying to reduce their salt use, but believes that more public outreach is necessary to change the public's perception of salt use in Oshkosh. The public needs to know the full impacts of how much salt they are using and where it ends up after it runs off in order to understand why they should not expect streets to be cleared and salted right away all of the time. Kelly hopes to continue educating the public on how to properly apply the right amount of salt to their own properties as well as the importance of sweeping up excess salt after snow and ice have melted. With more workshops, campaigns, and less salt use, these issues can be mitigated more effectively (see Appendix E and Public Outreach and Education in the Barriers section).

B. Korin Doering (Winnebago Waterways Coordinator at the Fox-Wolf Watershed Alliance)

Korin Doering is the Winnebago Waterways Coordinator at the Fox-Wolf Watershed Alliance. Korin joined the Fox-Wolf Watershed Alliance about six years ago with a background in aquatic and wetlands with a master's degree in water resource management from UW-Madison.

After speaking to Brad Spanbauer about what the City of Oshkosh could do to develop more testing for chloride and dissolved solid levels, the idea was to find out what is already being done in the Fox Valley area. Surprised to learn that testing is taking place already in seven different locations from the mouth of the Fox River at Lake Winnebago and up to Green Bay where the Fox River flows into the bay of Lake Michigan. After discussing more, tests are done

in March and April when the water is still cold so there is no algae bloom and less growth in the water.

One barrier that Korin talks about is the education of the public and that many people do not understand the importance of having low chloride and dissolved solid levels. If people do understand that having these high levels is a problem, they tend to not understand the why and how aspects of it. Making people aware and conscious of the unsustainable practices of road salt and the issues because of it will make people want change.

C. James Rabe (Director of Public Works in Oshkosh)

James Rabe has been the Director of Public Works in Oshkosh for five years, and is in charge of the buying, storing, and spreading of road salt on Oshkosh roads. While James does see the damage road salt can have on the environment, wildlife, and roads and walkways, he has described it as a “Necessary Evil” because of the beneficial effects it has on clearing ice from roads. James also previously served as the Stormwater Utility Engineering Supervisor for nine years, which gives him a different perspective when seeing road salt’s negative effects.

When speaking with James, one thing that he has noticed has been corrosion to stormwater drain pipes, especially where there is some exposed pipe to the air. The exposure to air, mixed with water and road salt, can and has caused corrosion much quicker and has shortened the potential life that these pipes can have. James also noted that all the road drains empty into the waterways around the city, meaning all the excess salt gets washed into the drains and thus into the waterways.

Like our other stakeholders, James is also big on educating the public about how and when to properly use salt. In Oshkosh, the property owners adjacent to the sidewalks are responsible for clearing all ice and snow from the area. James also pointed out that oversalting and using salt on newly poured concrete are big reasons there is damage to the concrete sidewalks and grass in the area.

D. Lisa Mick (Supervisor of the Grounds and Automotives, Facilities Management)

Lisa Mick is currently in her 7th year as the Supervisor of the Grounds and Automotives, Facilities Management at the University of Wisconsin-Oshkosh. Like James Rabe, she is in charge of buying, storing, and when/where to spread the salt on the campus of UWO, which can cost between \$30,000 to \$35,000 per winter for our small campus roads and sidewalks.

Lisa does understand the damage that salt can have on the environment and walkways but also recognizes how it can be helpful in a state with tough winters. Damage has been seen particularly on concrete walkways, like leading up to the Student Recreation Center and in front of the dorms where there is a large amount of foot traffic. And damage in the way of corrosion to drainage systems, like the rusted drain in front of Polk Library. She stated how the university has looked into alternatives, but it has been difficult to get the gears moving with a budget that has been struggling in recent years and not getting much help from the University. But there has been a slight modification the campus has tried, which has been by switching from regular grass to a

grass-like substitute that thrives off high sodium levels. Doing this has helped decrease the amount of salt runoff, but not in a drastic way.

Education was also a key thing she pointed to when trying to minimize the use of salt on campus. Being in her position, throughout the winter she will get complaints from students and staff calling for more salt in certain areas. And although sometimes these complaints are well-founded, oftentimes salt won't help the issues being complained about, such as snowy areas where salt would have no effect or areas that would become more slippery by adding salt.

E. Brad Spanbauer (Sustainability Officer at UW-Oshkosh)

Professor Brad Spanbauer has spent the last seven years teaching Biology 105 and being a sustainability officer here on UW-Oshkosh's campus. He graduated from the University of Wisconsin-Oshkosh with a master's degree in biology and has been practicing sustainability in Oshkosh ever since graduating. Due to his knowledge of sustainability, talking to Brad a little more about what the City of Oshkosh could do to become more sustainable with road salt use and how it is affecting our water quality.

When speaking with Brad he seemed very motivated by the fact that the City of Oshkosh does not do a good job of showing the results of chloride and dissolved solids tests done in Lake Winnebago and the Fox River. He explains that when tests are done and the results are in that the results are too complicated for the everyday person and he admits that he often struggles to understand what he is reading.

What Brad would like to see the City of Oshkosh do to become more sustainable with road salt use and to keep our water quality clean is to create two testing times. One test is done in the fall right before the snowfall, and another test is done in spring when all the ice is gone. Having two tests will allow more data to be collected to understand how much of an impact the road salt is having on rising chloride and dissolved solid levels. Once the results are in, sending out the results to residents of Oshkosh in an easy understanding format via email will make people a lot more aware of the issue with road salt.

F. Dr. Shannon Davis-Foust (Senior Lecturer, Environmental Studies & Biology, UW-Oshkosh)

Dr. Shannon Davis-Foust, a professor of Biology at the University of Wisconsin-Oshkosh has her Ph.D. in Aquatic Biology and 20 years of experience with invasive species. Since road salt can impact native species, making room for more salt-tolerant invasive species to move in, her expertise can be valuable to this research. Dr. Davis-Foust is a primary stakeholder because of her expertise and experience driving on Oshkosh's salted roads every year.

Dr. Davis-Foust sees the impacts of road salt as a threat to the biodiversity of Oshkosh as more invasive species cause the native species' populations to decline. She explained that biodiversity is vital to the health of ecosystems and society since ecotourism relies on biodiversity as well. One action suggested was to have more roadside buffers to trap and retain runoff instead of allowing ditches to bring runoff right to the waterways. Stormwater retention

ponds were brought up as a possibility to control runoff as well. Planting native plants as a roadside buffer will leave less room for invasive species to move in as well as naturally filtering the salty runoff.

It was clear that Dr. Davis-Foust understood that road salt is a big issue impacting the environment and society around it. She brought some great suggestions to the table which could further help to mitigate salt impacts other than replacing it with another alternative. Since any alternative to road salt could also have impacts on the environment, society, and economy when spread excessively on roads, it would benefit the environment to have another barrier on the roadside to prevent runoff from reaching the waterways as she suggested.

G. Michelle Bogden Muetzel (Program Manager, Office of Sponsored Programs, UW-Oshkosh & Vice Chair, Oshkosh Sustainability Advisory Board)

Michelle Bogden Muetzel is the Vice-Chair on the city of Oshkosh's Sustainability Advisory Board, and she has a Bachelor of Arts in Environmental Policy (which she received from UW Oshkosh). Michelle plays a key role in advising and influencing the city on sustainable changes it can make, and she was the person to first bring road salt usage to the attention of the board.

While Michelle is not an expert in road salt usage, her position on the Sustainability Advisory Board and in the community make her a primary stakeholder on the matter. Her knowledge of Oshkosh's current salt use policy was limited, but she was eager to learn more about possible alternatives that the city could use. She was also a strong proponent of ensuring that any proposals to amend the current road deicing policy were thoroughly discussed with the public works department, city managers, and any other parties involved in the process.

Many of the suggestions Michelle had regarding the reduction of road salt, in general, came from informational emails she received from Wisconsin Salt Wise, specifically during the Salt Awareness Week in January of 2021. Additionally, she attended some of the webinars that Wisconsin Salt Wise offers and suggested that other members of the Sustainability Advisory Board attend these as well. In general, as do most of our stakeholders, Michelle views road salt as environmentally and infrastructurally harmful and would like to see the city reduce its road salt use.

H. Allison Madison (Wisconsin Salt Wise Sustainability and Development Coordinator)

Allison Madison, the Sustainability and Development Coordinator of Wisconsin Salt Wise, has a Master of Science in Environmental Science received from UW Madison, as well as a graduate certificate in Environmental Education received from the University of Minnesota - Duluth. She also has over ten years of experience teaching about environmental science and sustainability. Although she has no stake in Oshkosh specifically, Allison's education, teaching experience, and professional experience regarding road salt reduction make her an excellent informational resource and an expert stakeholder for this project.

From a young age, Allison has held freshwater and recreational water activities close to her heart; it is this love for freshwater and a desire to conserve it that motivates Allison to reduce salt use and opt for less harmful alternatives. Allison's organization Wisconsin Salt Wise, a partnership of various cities, counties, municipalities, and organizations, has worked diligently to reduce salt use throughout the state of Wisconsin. According to Allison, the first steps toward reducing salt use begin with education (for city officials, public works, and the general public), training on best practices for road crews, calibrating equipment regularly (this alone can reduce salt use by 40-50% within the first year), and finally implementing a salt brine solution (salt/water solution containing 23.3% salt).

Overall, Allison seemed optimistic about her work and the potential for Wisconsin to continue to reduce its salt use. In terms of Oshkosh specifically, she indicated that she believes the city is off to a good start in its salt reduction efforts, and suggested further education and salt brine additives, such as beet juice, would be a great addition to the current policy.

I. Tom Otte (Solutions Consultant at Green Earth Co.)

Tom will be the main contact for following through with ordering these products. He was the one to give us all of the great information on Green Earth's Salt Saver salt brine. Tom was very helpful in providing information about available products and even provided assurance that if the products don't work, all unopened items can be returned to the company and fully refunded. In addition to Green Earth being an incredibly customer-friendly company, they are locally sourced, making for easy communication and transportation of products. Tom was able to provide statistics regarding the usage of each of his recommended products and was able to address concerns we had about other products we had previously considered. Additionally, Tom examples of other universities and businesses that use Green Earth's products, including Marquette University and O'Hare International parking ramps. Tom is a useful stakeholder within this proposal, as he is incredibly knowledgeable about his company's products, and is very attentive to the specific needs of each customer.

V. Benchmarking

A. UW-Oshkosh - Salt Saver

UW-Oshkosh received a Green Fund proposal to try Salt Saver on the campus this winter. Green Fund is a student-led organization that funds sustainable improvements submitted by other students. By using this product, salt usage will be cut in half. The normal 40 tons, or about \$30,000, of salt that campus uses per year will go down to 20 tons, or about \$15,000 (Lisa Mick - see Stakeholders). By using about \$5,000 worth of Salt Saver and pre-treated bagged salt, the campus is estimated to save about \$10,000 per year on de-icing the roads and sidewalks. The salt trucks will save on fuel since they will be able to go twice as far with the same amount of salt that's treated with the Salt Saver brine. This will also result in less corrosion and damage to concrete since the Salt Saver contains corrosion inhibitors and is coated with potassium acetate

to reduce damage to grass and other plants. The Salt Saver will also be able to work in colder temperatures down to negative 25 degrees Fahrenheit, whereas salt alone stops being effective at just 17 degrees Fahrenheit. (Info gathered from Tom Otte - see Stakeholders). For more information see Appendices A and B.

B. Eau Claire, WI - Beet Juice

For benchmarking research, focusing on cities that are surrounded by water and that are very dependent on water resources in the area would be beneficial because of their similarities to Oshkosh. The first place that seemed interesting was Eau Claire because the population size is similar to Oshkosh and because of the importance of the Chippewa River that runs right through the city, similar to the Fox River. In 2018, the City of Eau Claire used about 1,000 gallons of beet juice to help melt and remove ice off of roads to make them safer to drive on. The city also used about 53,000 gallons of salt brine and 1,300 tons of salt to go along with the beet juice. In past years the City of Eau Claire has used a calcium chloride application before and after it snows to not allow the ice to be able to stick to the roads, making it easier to plow. With that being said, over time they have found that chloride levels have been on the rise with water testing being done at the Chippewa River. With the calcium chloride that is used in road salt being the prime suspect for chloride levels rising, the City of Eau Claire wanted to make a change. This change was substituting the calcium chloride out for beet juice because of the many similar characteristics of the two substances and less harm the juice will have on the environment. With this change being fairly new, the pricing for the beet juice has been very similar but over time will save money and the environment. When discussing the cost a little more, the beet juice can be mixed in with the salt allowing for less salt to be used. With salt being the most expensive option, using less salt saved Eau Claire a lot of money.

C. Lake George, NY - Beet Juice

Another benchmarking example that used beet juice as an alternative to road salt is Lake George in New York. This place is unique and similar to Oshkosh because it is located on a highly touristed lake named Lake Geroge, very similar to Lake Winnebago and Oshkosh. Lake George was one of the first areas in the United States to try using a beet juice brine on its roads. The plow crews started using the “Ice Bite” product from the company Road Solutions Inc. in 2014 and continue these practices today. The “Ice Bite” solution is also called Geomelt, which is a natural liquid surface treatment that is an agricultural-based product derived from a sugar beet process blended with sodium chloride brine to make a liquid for anti-icing and de-icing that is less corrosive than brine alone. The Road Solutions Inc. is located in Indianapolis, Indiana making a prime location for beet farmers to sell products in order to make more Geomelt. (Technical data sheets regarding Geomelt product and safety information can be found in Appendices A and B, respectively.) When purchasing the Geomelt, a quote can be put in for the price that will depend on how much is needed and how it will be transported.

D. Waukesha County, WI - Beet Juice

Another significant benchmarking example, which also uses beet juice as an additive to salt brine, is Waukesha County, WI. In terms of similarity, the city of Waukesha has a similar population and area (in square miles) to Oshkosh, and both cities also have a river running through them. Waukesha has been using beet juice, specifically the product Geomelt, as an additive to its salt brine since 2013 (along with another additive - 32% concentration calcium chloride). The salt brine ratio consists of 85% salt brine, 10% beet juice, and 5% calcium chloride; the brine may be used on its own as an anti-icing method (meaning it is laid on the road before a weather event to prevent the bond between ice and pavement) or in conjunction with conventional road salt as a de-icing method (meaning it is applied during or after a weather event to loosen the bond between ice and pavement and to make ice and snow more “plowable”). According to its Winter Highway Management Plan, Waukesha pre-wets almost all of its road salt to reduce the amount of salt that bounces off the road upon application (the only time this is not the case is preceding a freezing rain event). Its fleet vehicles, which are calibrated every year (or more often if needed), can spray any combination between 100% road salt and 100% salt brine; typically, 70% road salt and 30% salt brine proves to be the most effective, though these percentages are adjusted depending on the specific weather conditions. In terms of volume, the vehicles can hold anywhere from 65-500 gallons of brine, and the smaller vehicles spray 8 gallons of brine per ton of salt, while the larger vehicles spray 20-40 gallons of brine per ton of salt. Since implementing these winter road maintenance strategies, Waukesha has been able to reduce its road salt use by 20-35% annually. (Chladil and Bussler 2015)

E. Polk County - Cheese Brine

Polk County was using cheese brine as a de-icing agent on their roads since 2008. About 30,000 to 65,000 gallons of cheese brine were used in pre-wetting techniques with salt every year. Pre-wetting is when the liquid brine is mixed with the salt beforehand to make it stick to the roads easier, meaning about 40% less salt is required. The local dairy operation normally would have had to pay to dispose of the wasted cheese brine, however, the city and the operation made a deal. The operation was able to dispose of the cheese brine for free while the city obtained it free of charge. By doing this, the city saved up to \$90,000 per year. The community has had no complaints so far about the brine leaving behind any residue or smell. However, the brine is also very salty and can lead to oxygen deficiencies in water sources it may runoff into. Not many studies have been done on the effects cheese brine may cause, but it is clear that it is much better than road salt at melting the ice faster at lower temperatures.

Polk County unfortunately no longer uses cheese brine because the dairy operation they were sourcing the brine from was bought out and shut down. They are currently looking into other options, but have not found any that they like as much. (See attached pdf for Polk County’s report and conclusions) (Yaccino, Steven. “Pouring Cheese on Icy Roads in (Where Else?) Wisconsin.”).

VI. Costs

Comparing the costs of each of the salt additive options, the cheese brine would be the cheapest since the only cost would come from transportation, as it could potentially be sourced for free if there was a nearby dairy operation willing to give away their brine, though we did not find any around this area (see Barriers). The Salt Saver, on the other hand, is from Green Earth Company in Fond Du Lac so it is cheap and local, cutting salt usage in half versus the 30% reduction that organics (cheese brine and beet juice) average. The Geomelt beet juice would still be a fairly cheap option, saving the city money as the aforementioned two options, however, it is not located as close to Oshkosh, nor as easily sourced (see Barriers). Overall, all of these options will save costs on infrastructure damages, the amount of salt needed, and spare some wear and tear on residents' vehicles.

A. Salt Saver by Green Earth

- Half the salt is needed
- Salt Saver is \$2582.25 per 275 gallon tote
- 275 gallons will treat up to 91 tons of salt
- City will save \$100,000 to \$150,000 on salt per year total
- There will also be savings in fuel because the trucks will be able to go twice as far with the same amount of salt
- Savings in damage costs (estimated at \$10 per \$1 of salt) will also be cut in half

The Salt Saver liquid brine from Green Earth Co. comes in 275 gallon totes which are \$2582.25 each, averaging out to about \$9.39 per gallon. Although this may seem costly upfront, this product melts ice so effectively that salt usage will be cut in half, saving the city \$100,000 to \$150,000 per year on salt. The Salt Saver also only requires 3 gallons to be used per ton of salt so one tote will last for about 90 tons of salt. The time spent mixing the brine with salt is estimated to take about 20 minutes per 10 tons of salt, so this will not add too much time to the salting process. Green Earth Co. has offered to provide free training for the salt applicators to ensure they understand how to spread the treated salt since less will have to be used. The Green Earth Co. is located in Fond Du Lac so they are willing to ship the product to the city. This will cost about \$75 per tote. These prices reflect the discount given if products are ordered before July or August when demand increases. Overall, with the city using up to 4,000 tons of salt each year, it is estimated that the city will still save about \$35,000 every year by paying for the product plus shipping since only half the salt will need to be purchased.

B. Beet Juice

- 2/3 the salt is needed
- Geomelt is \$1,086.25 per 275 gallon tote
- 275 gallons will treat up to 55 tons of salt
- City will save between \$60,000 and \$75,000 on salt per year

- Savings on damage to infrastructure will be reduced by 1/3

As seen in benchmarking examples, the cost of a deicing solution will be relatively expensive upfront but will become more cost-effective in the long run. One major supplier of the Geomelt used in Lake George was the Road Solutions Inc. in Indianapolis, Indiana. Since this is about a seven-hour truck drive it would be somewhat costly to travel fourteen hours to attain the Geomelt. Paying people to drive the trucks and help load would also play a big role in cost. Other Wisconsin cities and municipalities using Geomelt have sourced it from SNI Solutions in Geneseo, Illinois, which would only be a four-hour drive; however, there would still be costs associated with the transportation of the product to the city.

When it comes to the actual cost of the Geomelt, according to Waverly Industries, a 275 gallon tote costs \$1,086.25. One tote of Geomelt would treat 55 tons of salt, which means the city would need to buy about 51 totes, which would treat 2800 tons of salt and would be a total cost of \$55,398. Using Geomelt would reduce the amount of salt the city would need to purchase by about 30%, which would be between \$60,000 and \$75,000 on salt per summer, which would lead to a savings of about \$10,000 per winter for the city. Similar to Salt Saver, using Geomelt would also reduce the costs associated with damage to infrastructure, residential and fleet vehicles, and equipment.

C. Cheese Brine

- Cheese brine is free from dairy operations
- Only cost is transportation and fuel to spread the de-icing solution estimated by Polk County to be 0.07 cents per gallon total (see attached pdf for Polk County's full report)

Polk County has been using cheese brine on their roads since 2008. They made a deal with a local dairy operation to take the cheese brine off of their hands for free, something they would have had to pay to dispose of otherwise, and use it as a de-icer throughout the county. The issue is finding an operation that still disposes of their brine (see Barriers).

D. Sand/Granular Material

- Average price of \$9.50 per ton
- Would need to purchase more because it can bounce off the road more easily

The city of Oshkosh does already use sand/granular material, but that is only on specific occasions when weather conditions allow, as dictated by James Rabe. It is oftentimes only used when a large snowfall is followed by subfreezing temperatures that are too cold for road salt to be functional. Although the sand/granular material mixture is not used to de-ice the roads, it is still used to provide traction to roads that are slippery and could be dangerous to drive on. The average cost of sand per ton is cheaper than salt per ton, but in some cases will have to be reapplied if there is snow covering the ice on the roads.

VII. Barriers

A. Salt Saver

There are few barriers to using this product since it is sourced locally and can be shipped to the City. It is one of the cheapest options, however, there are not as many benchmarking examples available for this product as compared to the other options. The company still currently works with other cities and universities, like the University of Marquette and UW-Oshkosh. UW-Oshkosh will be using this product for the first time this winter, so the city of Oshkosh can keep in contact with them to see how it goes. Along with that, they also offer full refunds to customers if there is any dissatisfaction with the product or its effectiveness, but they have not had any complaints about their products thus far.

B. Beet Juice

One of the barriers to using a beet juice brine is the sourcing of the beets. Because the closest beet farms are in western Minnesota and eastern Michigan, and the closest beet factory being in Chippewa Falls, Wisconsin. Another barrier to using the beet juice brine is that it can temporarily stain the roads and cars if sprayed carelessly. The dark color associated with the application of beet juice may be beneficial in its ice melting capacity, but the color can also be viewed as a downside in some regards as well. This could prove to be confusing for road crews as they may mistake the dark roads for black ice, and subsequently reapply deicing measures. (Terry et al. 2020) In addition, the general public may express discontent with the color of the roads and potential staining that may occur to vehicles. Although the beet juice brine won't cause long-term damage to the roads or cars, it could be unappealing to the city and the residents. Though these downsides are somewhat more superficial than others, providing educational materials for both road crews and the general public, as suggested by most of our stakeholders, on the benefits of utilizing beet juice on the city's roadways could help to alleviate these negative outlooks.

One more potential tradeoff for organic additives, mentioned in more detail above, is financial cost (see Costs). The initial purchase of this type of additive may be potentially high, but the savings associated with reduced salt use, especially when considered with the rising trend of salt prices in recent years, could potentially cover the costs in the long run. Additionally, implementing an educational campaign on the harmful effects of road salt and the benefits of reduction and safer alternatives, a little to no cost initiative, would further reduce these road salt costs and thus cover the initial costs of the organic additive purchase.

The runoff of the beet juice brine can also cause somewhat of a problem in the waterways because of the sugar runoff. The runoff from the brine can cause a problem because the breakdown of the sugar in the beet juice can consume the dissolved oxygen within the water, which is essential to aquatic life. When used in moderation and as a brine additive rather than a standalone deicing product, however, the dissolved oxygen issue can be reduced.

C. Cheese Brine

Polk County was able to find an operation to source brine from in 2008. Since then, many dairy operations have been more aware of their costs and have switched to reusing their brines by filtering them and adding more salt when needed. Oshkosh has a few dairy operations nearby, Knaus Cheese (Fond Du Lac) and Weyauwega Star Dairy (Weyauwega); unfortunately, these operations reuse their cheese brine instead of disposing of it, but the city could still potentially have a conversation with either of them about that possibility. It seems as though many dairy operations have recently made this switch from disposing to reusing their cheese brine to save more money. Cheese brine, being an organic material, also poses the impacts of decreasing the oxygen levels in waterways which affects the aquatic wildlife, just as beet juice does, yet arguably still has significantly fewer cons and more pros than salt alone.

D. Sand / Granular Material

Sand or a granular material can be a viable alternative to road salt, but it also has barriers too. One of the main roadblocks is that road sand is ineffective and can't be applied when there is snow or when it is snowing because it is only useful when there's only ice on the roads. Since it is used just for vehicles to get traction, it becomes ineffective when snow is on top of it. Another barrier is that if it's not mixed with some percent of salt, it can also freeze causing it to clump. When the sand freezes into clumps, it not only becomes ineffective but can plug up the equipment in the trucks that deposit it, making the truck useless until it gets fixed. Proper training should ensure that this does not happen often.

E. Public Outreach and Education

One barrier that poses opposition towards a plan to reduce road salt use is that the majority of the public would prefer to see bare roads in the winter to improve their safety while driving. These people push for more salt use, but our research shows that adding an additive can reduce salt use, improve the effectiveness of the salt that is used, and increase the range of temperatures at which salt can be used. Less salt use also means that people's cars will not rust as quickly, and fewer potholes will be created, which will further reduce damage to vehicles. Whichever option the city decides to go with, the public should be informed of the greater number of benefits it has compared to salt.

Kelly Reyer, Korin Doering, Allison Madison, Shannon Davis-Foust, Brad Spanbauer, Lisa Mick, and James Rabe (see Stakeholders) all suggested more public outreach and education as being a priority because in helping the public to understand the issues road salt causes it will make it easier for the city and citizens to make more decisions to mitigate their impacts. Kelly Reyer and Allison Madison have been doing this for years already for people such as James Rabe, the Director of Public Works, to attend. If more of these events can be hosted in Oshkosh or more information made available and understandable for the public, such as the rising chloride levels seen in Oshkosh's waterways, then more action will be taken. See Appendix E for Kelly Reyer and Allison Madison's Salt Wise presentation.

VIII. Significance for Sustainability

Seeing that some of the readings are showing chloride levels above both the EPA's threshold of chloride toxicity of 230ppm (mg/L) and the Wisconsin DNR's threshold of 395ppm (mg/L) has been alarming to Kelly Reyer (see Stakeholders) in recent years. She has noticed that salt has been showing up in the public drinking water wells, and if the levels get too high, the water is no longer safe to consume. Salt also causes a lot of damage to the trees, roads, vehicles, and infrastructure which she estimated came out to about \$10 of damage per every \$1 of salt used on the roads.

By implementing an organic additive, meaning beet juice or cheese brine, or an acetate-based additive (Salt Saver) as well as increasing the use of sand in its current snow and ice removal policy, the city of Oshkosh would be directly addressing a goal in its current Sustainability Plan, specifically goal #5 under the subheading "Street Design and Maintenance" in the Enhance Mobility Alternatives to the Automobile; Design Safe, Efficient and Environmentally Sound Transportation Infrastructure; and Connect to Other Local and Regional Networks section. The goal states that the city would like to "Address polluted run-off issues related to salt usage and other methods of snow and ice removal." Having the city supplement its use of traditional road salt with beet juice, cheese brine, or Salt Saver, as well as increasing its use of sand, would not only achieve this goal but provide additional benefits to the city as well.

First and foremost, making the changes that we have recommended in this report would directly achieve Oshkosh's stated goal of reducing runoff pollution associated with road salt use. The salt brine solution that Oshkosh already uses for both anti-icing and de-icing (when combined with road salt through a pre-wetting technique) works toward this goal. However, by combining an organic additive with the salt brine solution, both pre-wetted solid salt and brine remain on the road longer, meaning that it's less likely for the products laid down to runoff. Additionally, when salt and brine remain on the road longer, less of each can be used and therefore salt runoff is reduced even further. Another benefit to the increased stickiness of the organically supplemented brine is higher traction for vehicles, meaning that roadways would be safer for drivers during winter months. (Terry et. al 2020)

Not only are organic additives effective at reducing runoff, but they're also simply more effective at what they're supposed to do - prevent ice from bonding to pavement and lower the eutectic temperature of ice (i.e. the temperature at which ice forms). Conventional road salt has a minimum effective temperature of -5.8°F, but when combined with the organic additive, the minimum effective temperature can be as low as -45°F. This is partially due to the combination of sugar and salt being more effective at melting ice, in addition to the dark color of the brine being able to absorb more heat, and therefore melt ice more effectively than salt brine alone. Yet another way these organic additives outshine road salt is in decreased corrosivity potential, meaning that they can reduce and even prevent corrosion of equipment and infrastructure (Terry et. al 2020)

In terms of environmental impacts, organic additives are markedly less damaging than conventional road salt, although that does not mean that they come without some tradeoffs. While organics like beet juice and cheese brine do not contribute to the chloride pollution currently observed with continued salt use, nor do they have any observable negative effects on roadside vegetation, the fact that they are composed of organic material means that they will decompose; in terms of water quality, the decomposition process of the organic matter that reaches water bodies will consume dissolved oxygen (DO), which is essential for aquatic life. (Terry et. al 2020) Schuler et al. performed an experiment comparing the effects of road salt and various alternatives, however, and found that while after initial use of an organic deicer DO content decreased, after extended use the DO levels were comparable to their control variable. (2017)

Additionally, the experiment found that any phosphorus runoff, which initially is deposited in an unusable form, was transformed into a usable form by microbial communities. While this could lead to an alteration of the trophic levels in the ecosystem, increased levels of usable phosphorus could lead to increased populations of phytoplankton, which in turn could lead to increased levels of zooplankton, and eventually lead to fewer algal blooms. (Schuler et al. 2017) Should the city opt for organic additives in its salt brine, implementing strictly targeted applications with the organic additives as a preventative measure before major winter weather events could reduce the overall amount that may end up in the city's waterways.

Cleaner and healthier waterways, a resurgence of healthier native plants, a lessening of invasive, sodium thriving plants, safer and healthier land and water organisms, longer lifespans of roads, walkways, and draining systems, and long term financial savings for the city are all reasons why the city of Oshkosh would benefit significantly by implementing our recommendations. No alternative is without tradeoffs, but in this case, the benefits far outweigh the costs.

IX. Summary/Conclusion

Conventional road salt has been damaging the waterways, vegetation, and infrastructure of Oshkosh for too long. The city has made headway in reducing its salt use in recent years by implementing sand and a salt brine solution, but further action can be taken. By utilizing additional sand and implementing either an organic additive, beet juice or cheese brine, or Salt Saver to its salt brine, something that multiple other cities in Wisconsin are already doing, Oshkosh could reduce the amount of salt runoff that enters its freshwater ecosystems and drinking water, the corrosivity that occurs in vehicles, bridges, and roadways, and its overall spending on de-icing measures, both in labor and in the products used. In addition, conducting an educational campaign targeted toward the general public on the negative effects of road salt would mobilize citizens to assist the city in its salt reduction efforts. Oshkosh prides itself on being a leader in sustainability; by implementing these changes to its snow and ice removal efforts, the city would reinforce its dedication on this front.

X. Works Cited

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XI. Appendix A: Salt Saver Safety Data Sheet (See attached pdf)

XII. Appendix B: Additional options with Green Earth Co.

Tom Otte (see Stakeholders) with Green Earth Co. also mentioned that they “have designed a way for smaller airports who can't afford a big fancy dump truck de-icing system to have an easy way to pretreat the runway with liquid. It is a turnkey system that our friends at Contree Sprayer in Beaver Dam supply to our customers. Turnkey cost for the sprayer system is around \$1,900 for pump, sprayers, boom, hoses, wiring/switch. (see attached photos) Green

Earth Co will gladly donate the first empty tote for keeping in the truck. (truck weight limits usually don't allow for a full tote in the pickup bed.) It fits in the back of any existing pickup truck, sprayer boom slips right into the Reese hitch of the truck. Designate an old pickup. It is an easy installation to put it in the back for 6 months of the year. It sprays at 30 PSI to whatever width you design between 8 to 26 feet wide. Contree will help you choose the proper nozzles for your desired width.”



“I would recommend you look at our Super Brine which is an ENHANCED SALT BRINE. This will Lower the melting temp even more, and the potassium acetate will hold the moisture and keep the brine in liquid form rather than evaporating into white dust clouds on the surface. This is great for pretreating the more dangerous curves, hills, bridge inclines. Applied at 1/2 gallon/1000 sq feet. It may not get used everywhere the normal salt brine does, but the enhanced Super Brine could be the specialty truck tank for the dangerous trouble spots. The city of Oshkosh could acquire it from us pre-mixed in totes. Small airports have been very happy with a more affordable sprayer option for the smaller runways, and the city wouldn't need to purchase new equipment. It's an easy and affordable retrofit of an old existing pickup parked in the back lot. Super Brine price is very affordable at \$1.56/gallon in 275 gallon totes. Free on board shipping from Chilton, WI is included.” (See attached pdf on Super Brine). Tom Otte has also mentioned that Green Earth would provide free training for Oshkosh’s salt applicators to show them how to more effectively spread salt when less is needed to melt the ice.

XIII. Appendix C: Geomelt Product Data Sheet (See attached pdf)

XIV. Appendix D: Geomelt Safety Data Sheet (See attached pdf)

XV. Appendix E: Polk County Report and Conclusions (See attached pdf)

XVI. Appendix F: Salt Wise - Community Campaign & Chloride Monitoring presentation by Kelly Reyer and Allison Madison (See Stakeholders)

Here are just a few of the slides from the Watershed Conference presentation which Kelly Reyer and Allison Madison shared. They have some public education tips included which would be great knowledge to share. This is meant to show what an event hosted by Salt Wise would look like. They include more about economic and environmental impacts as well.

Will You Be a Salt Wise Champion?

- **Be Salt Wise at Home**
 - Shovel, Scatter, Switch, Sweep
 - Assess your water softener
- **Public Outreach: Spread the word (not the salt)!**
 - Doorhangers
 - Social Media
 - CI Monitoring – **Host a Salt Wise Summer Paddle**
- **Promote Salt Wise Certification**
 - Free 4-hour trainings in 2021
 - **Friday, March 12 – “Smart Salting for WI Roads”**
 - August-November classes, dates TBD
 - Roads; Parking Lots and Sidewalks

Wisconsin Salt Wise

Once you put salt down, it doesn't go away!

All of the winter salt that we apply ends up in our soil or local waterways. Once salt is in our waterways, it's here to stay.

Chloride from salt is toxic to aquatic life.

Salt infiltration has also been observed in local drinking water wells.

It only takes 1 teaspoon of salt to pollute 5 gallons of water

Safe Sidewalks and Clean Water

First, remove as much snow and ice as you can before applying salt. If extra salt remains after pavement is clear, please sweep it up to protect our lakes, streams and drinking water.

Are out your winter maintenance? Ask them to get "Salt Wise Certified!"

Learn more at www.wisaltwise.com

WI Salt Awareness Week

January 11th - 15th

#thetruecostofsalt
The true cost of salt to our freshwater infrastructure, wildlife and pets may be higher than you think!

Webinars livestreamed via YouTube (12:30-1pm every day)

Monday
Salty Streams and Forcibly Freshwater Lakes: An Ecosystem Perspective

Tuesday
Be Salt Wise and Pet Smart

Wednesday
Salt Your Dinner. Not Our Drinking Water

Thursday
Put Your House/Business on a Low-Salt Diet

Friday
Success Stories From Across Wisconsin

Learn more at WISaltWise.com

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to p... like Salt Bae

Wisconsin Salt Wise

[wisaltwise](http://wisaltwise.com)

Sponsored by

Wisconsin Salt Wise

Home | #thetruecostofsalt | Take Action | For Winter Maintenance Professionals | About Us

Winter Salt Certification

Upcoming Classes:
Smart Salting for Roads - February 11, 8am
Smart Salting for Roads - February 23, 8am

Salt Wise Winter Salt Certification classes are open to public and decision-making. The City of Madison, the Fox-Wolf Watershed, and other organizations have participated in trainings across the state. Additional 2021 trainings will be posted.

one involved in winter maintenance. Pike WIN, and Waukesha County.

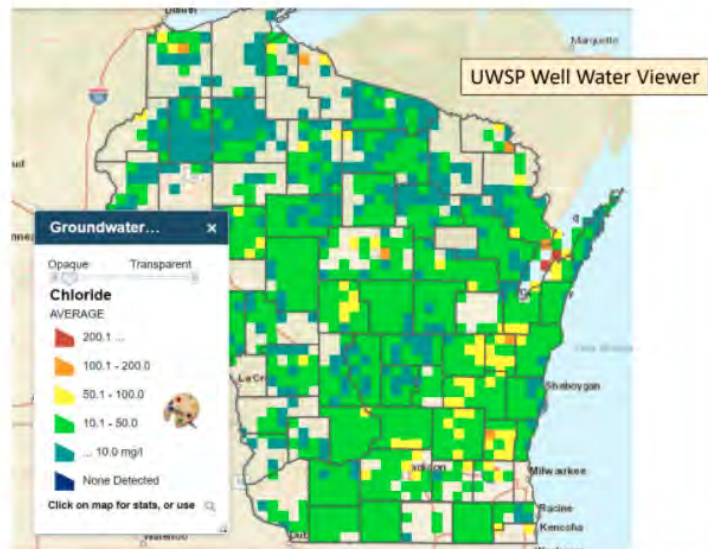
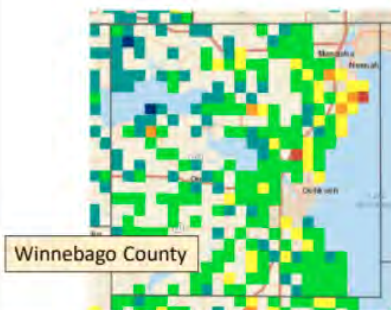
Share

Winter Salt Grille

PROTECTING WISCONSIN WATERSHEDS
PROUD TO BE
SALT WISE

Chloride in our Groundwater

- Road Salt (NaCl)
- Water Softeners (NaCl)
- Fertilizers (KCl)
- Dust Suppressants (CaCl_2)



Chloride monitoring is considered an active participation activity for stormwater outreach and education for communities to document on their MS4 annual reports.



The chloride monitoring efforts should be accompanied with an educational campaign to teach residents about reducing salt use on their properties.



We've been sharing on social media



Chloride Sampling
Date: Friday, January 15, 2021
Location: Tributary—Menasha (44.211544 -88.404463)
Results: 8.6 Quantab Units or ~893ppm(mg/L) Cl⁻



FREE WINTER SALT WATCH KITS!





Green Earth Ice Melter Safety Data Sheet

Issue Date: 07-Dec-2015

Revision Date: 12-07-2015

Version 1

1. IDENTIFICATION

Product Identifier

Product Name Green Earth Ice Melter

Other means of identification

SDS # GE50 / GE25

Recommended use of the chemical and restrictions on use

Recommended Use Earth Friendly Ice Melter.

Details of the supplier of the safety data sheet

Distributor

The Green Earth Deicer Company, Inc.
N8580 County Rd. QQ
Malone, WI 53049

Emergency Telephone Number

Company Phone Number (800) 528-1922
Emergency Telephone (24 hr) Chem Tel: 1-800-255-3924

2. HAZARDS IDENTIFICATION

Appearance Light green solid **Physical State** Solid **Odor** Slight

Classification

This chemical does not meet the hazardous criteria set forth by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200). However, this Safety Data Sheet (SDS) contains valuable information critical to the safe handling and proper use of this product. This SDS should be retained and available for employees and other users of this product.

3. COMPOSITION/INFORMATION ON INGREDIENTS

The product contains no substances which, at their given concentration, are considered to be hazardous to health. However, additional component information is available in subsequent sections of this SDS.

4. FIRST-AID MEASURES

First Aid Measures

Eye Contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes.
Inhalation	Remove to fresh air.
Ingestion	Clean mouth with water and drink afterwards plenty of water.

Most important symptoms and effects

Symptoms	May cause mild irritation.
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Indication of any immediate medical attention and special treatment needed

Notes to Physician	Treat symptomatically.
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5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media Not determined.

Specific Hazards Arising from the Chemical

Not determined.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions	Use personal protective equipment as required.
Environmental Precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for Containment	Prevent further leakage or spillage if safe to do so.
Methods for Clean-Up	No special precautions. Sweep up and return to container or wash with large amounts of water.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on Safe Handling	Handle in accordance with good industrial hygiene and safety practice.
--------------------------------	--

Conditions for safe storage, including any incompatibilities

Storage Conditions	Material is deliquescent, so caking may occur with moisture and longtime storage. Practice reasonable care and cautions.
Incompatible Materials	Leather.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies
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Appropriate engineering controls

Engineering Controls	Ensure adequate ventilation, especially in confined areas.
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Individual protection measures, such as personal protective equipment

Eye/Face Protection	Wear protective eyeglasses or chemical safety goggles with side shields.
Skin and Body Protection	Rubber gloves.
Respiratory Protection	In case of insufficient ventilation, wear suitable respiratory equipment.

General Hygiene Considerations Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Solid	Odor	Slight
Appearance	Light green solid	Odor Threshold	Not determined
Color	Light green		
Property	Values	Remarks • Method	
pH	Not determined		
Melting Point/Freezing Point	116-118 °C / 240-244 °F	Partial Decomposition	
Boiling Point/Boiling Range	Not determined		
Flash Point	Not determined		
Evaporation Rate	Not determined		
Flammability (Solid, Gas)	Not determined		
Upper Flammability Limits	Not determined		
Lower Flammability Limit	Not determined		
Vapor Pressure	Not determined		
Vapor Density	Not determined		
Specific Gravity	Not determined		
Water Solubility	96%		
Solubility in other solvents	Not determined		
Partition Coefficient	Not determined		
Auto-ignition Temperature	Not determined		
Decomposition Temperature	Not determined		
Kinematic Viscosity	Not determined		
Dynamic Viscosity	Not determined		
Explosive Properties	Not determined		
Oxidizing Properties	Not determined		

10. STABILITY AND REACTIVITY

Reactivity

Not reactive under normal conditions.

Chemical Stability

Stable under recommended storage conditions.

Possibility of Hazardous Reactions

None under normal processing.

Hazardous Polymerization

Hazardous polymerization does not occur.

Conditions to Avoid

Keep out of reach of children.

Incompatible Materials

Leather.

Hazardous Decomposition Products

If evaporated to dryness and heated above 900°F, acidic vapors may occur.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure**Product Information****Eye Contact**

Avoid contact with eyes.

Skin Contact

Avoid contact with skin.

Inhalation

Avoid inhalation of dust.

Ingestion

Do not ingest.

Component Information

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Non-Hazardous Proprietary Materials	= 3250 mg/kg (Rat)	-	-
Sodium Chloride 7647-14-5	= 3 g/kg (Rat)	> 10 g/kg (Rabbit)	> 42 g/m ³ (Rat) 1 h

Information on physical, chemical and toxicological effects**Symptoms**

Please see section 4 of this SDS for symptoms.

Delayed and immediate effects as well as chronic effects from short and long-term exposure**Carcinogenicity**

Based on the information provided, this product does not contain any carcinogens or potential carcinogens as listed by OSHA, IARC or NTP.

Numerical measures of toxicity

Not determined

12. ECOLOGICAL INFORMATION

Ecotoxicity

The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Component Information

Chemical Name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Non-Hazardous Proprietary Materials		6800: 96 h Oncorhynchus mykiss mg/L LC50 semi-static		7170: 24 h Daphnia magna mg/L EC50
Sodium Chloride 7647-14-5		5560 - 6080: 96 h Lepomis macrochirus mg/L LC50 flow-through 12946: 96 h Lepomis macrochirus mg/L LC50 static 6020 - 7070: 96 h Pimephales promelas mg/L LC50 static 7050: 96 h Pimephales promelas mg/L LC50 semi-static 6420 - 6700: 96 h Pimephales promelas mg/L LC50 static 4747 - 7824: 96 h Oncorhynchus mykiss mg/L LC50 flow-through		1000: 48 h Daphnia magna mg/L EC50 340.7 - 469.2: 48 h Daphnia magna mg/L EC50 Static

Persistence/Degradability

Not determined.

Bioaccumulation

Not determined.

Mobility

Not determined

Other Adverse Effects

Not determined

13. DISPOSAL CONSIDERATIONS

Waste Treatment Methods

Disposal of Wastes

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated Packaging

Disposal should be in accordance with applicable regional, national and local laws and regulations.

14. TRANSPORT INFORMATION

Note

Please see current shipping paper for most up to date shipping information, including exemptions and special circumstances.

DOT

Not regulated

IATA

Not regulated

IMDG

Not regulated

15. REGULATORY INFORMATION

International Inventories

All ingredients are listed or exempt from listing on Chemical Substance Inventory

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

US Federal Regulations

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355).

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

This product does not contain any substances regulated under applicable state right-to-know regulations

16. OTHER INFORMATION

NFPA	Health Hazards	Flammability	Instability	Special Hazards
	Not determined	Not determined	Not determined	Not determined
HMIS	Health Hazards	Flammability	Physical Hazards	Personal Protection
	Not determined	Not determined	Not determined	Not determined

Issue Date: 15-Jan-2013
 Revision Date: 06-13-2015
 Revision Note: New format

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

Salt Saver - Liquid Treatment

Specialized stock pile and brine enhancer

SALT SAVER



BENEFITS

- Salt Saver™ is a liquid stock pile treatment that significantly reduces the amount of salt required to effectively de-ice your location
- Can also be added to salt in tailgate spreaders and effectively hand-mixed in seconds.
- Makes standard rock salt work faster, longer, and to colder temperatures
- You use less salt, saving you money, and reducing the harmful effects on the environment.
- Contains no chlorides, environmentally friendly, bio-degradable
- Does not contain beet juice or any other waste bi-products

APPLICATION

- To treat granular salt: apply 3 -3.5 gallons per ton of salt and mix evenly or apply approx 9-10 ounces per 50 lb bag of salt to tailgate spreader and mix thoroughly
- To make liquid "Super Salt Brine": add 10-20% by volume to liquid salt brine

(SAFE – Low Cost)

The Green Earth Company, Inc. – 1-800-528-1922 - www.TheGreenEarthCo.com



888-840-5564

www.snisolutions.com

PNS Qualified Product

GEOMELT[®] 55 Liquid Organic Accelerator

Product Data Sheet

GEOMELT[®] 55 Liquid Organic Accelerator is a natural agricultural product that features snow and ice control performance superior to traditional brines, but less corrosive. GEOMELT[®] 55 is derived from renewable resources providing a sustainable and environmentally sensitive alternative. GEOMELT[®] 55 will reduce salt application rates by 30% and substantially reduce operating costs.

Typical Properties

Appearance	Brown	Freeze Point	-40°F (-40°C)
Dry Solids	55%	pH	6.0 – 8.5
Specific Gravity	1.275	Water Solubility	Complete
Wt. / Gal.	10.5 pounds/gal		

Applications

GEOMELT[®] 55 is highly effective salt or salt / sand stockpile treatment, prewet, anti-icing, deicing, salt stock pile preservation treatment and bulk material freeze proofing. The suggested usage levels should be considered as starting points and should be adjusted based on field operator experience, current local conditions and weather expectations.

Salt or Salt / Sand Stockpile Treatment



Apply at 4-5 gals/ton (15-19 liters / metric ton)
 Reduce application rate 30%
 Freeze point -40°F (-40°C)
 Reduce Operating Cost
 Reduce bounce and scatter loss
 PDSgeo55-042414

Apply at 55% solids no need to dilute with Brines
 Prevents freezing, crusting – salt free flowing
 Truck and Employee can cover 30% more area
 Reduced corrosion
 Reduce equipment replacement cost

Prewet



Apply 6–10 gals / ton (21–42 liters / metric ton)**
Apply at spinner or auger
Blend GEOMELT® 55 with Na/Mg/Ca brines
Reduce application rate 30%
Freeze point -40°F (-40°C)
Reduce bounce and scatter loss

** Apply at recommended GEOMELT® blend ratios directly related to environmental conditions

Reduce Operating Cost
Truck and Employee can cover 30% more area
Reduced corrosion
Reduce equipment replacement cost
Increase Manpower & Equipment efficiency
Can use gravity flow application equipment

Anti – icing



Blend GEOMELT® 55 with Na/Mg/Ca brines
Apply at 20-30 gals / Ln mile(47-71 ltrs / kilometer)**
Reduced application rates 30% compared to Na Brine
Reduce application rate for Frost protection - bridges
Residual will last 4-6 days

** Apply at recommended GEOMELT® blend ratios directly related to environmental conditions

Apply before storm event to prevent Bonding
Prevents snow & ice bonding – removal easier
Truck and Employee can cover 30% more area
Increase Manpower & Equipment efficiency
Reduced corrosion

Deicing



Blend GEOMELT® 55 with Na/Mg/Ca brines
Apply at 50-60 gals / Ln mile(190-225 ltrs / kilometer)**

Allow product to penetrate – breaking bond to road
Burns through hardpack to break bond with road
Breaking bond makes removal easier

** Apply at recommended GEOMELT® blend ratios directly related to environmental conditions

Salt Stock Pile Preservation Treatment Bulk Material Freeze Proofing



Apply at 4-5 gals/ton (15-19 liters / metric ton)
Apply at 55% solids no need to dilute with Brines
Prevents freezing, crusting – salt free flowing
Prevents hardening over summer
Will not waste rock salt due to hardening

Freeze proof bulk materials, sand, aggregates
Can top coat salt with spray at 0.5 gal/yd²
Apply top coat spray with two applications
Non – Chloride, environmentally acceptable
Reduced corrosion

GEOMELT®55 is produced under U.S.Patent #6,080,330, additional Patents Pending.

The information and recommendations in this publication are to the best of sellers knowledge, accurate. However because of numerous factors affecting test results, seller makes no warranty of any kind, express or implied other than product conforms to its applicable current standard specifications. Statements concerning the use of the products or formulations described herein are not to be construed as recommending the infringement of any patent.

GEOMELT®USA Approved 04/24/14

PDSgeo55-042414



5616 Progress Road Indianapolis, IN 46241 1(888)888-3615

www.CPIRoadSolutions.com

Safety Data Sheet

SECTION 1 – Identification

Product: GEOMELT® 55 anti-icing/deicing fluid *(Previously called ICE BITE 55)*

Chemical Name: Trade Secret

Formula: Proprietary

Manufacturer: SNI Solutions

24-Hour Emergency Assistance: 888-840-5564

SECTION 2 –Hazard(s) identification

NFPA Identification - GEOMELT® 55 Health – 0, Fire – 0, Instability - 0.

NFPA – Hazard Identification: This system identifies the hazards in three categories: Health, Flammability and Reactivity and indicates the order of severity ranging from 4 indicating a severe hazard to 0 indicating no special hazard.

SARS-EPA SARA Title III Hazard Categories: 1-Fire Hazard, 2-Sudden Release of Pressure, 3-Reactive, 4-Immediate (Acute) Health Hazard, 5-Delayed (Chronic) Health Hazard.

SECTION 3 – Composition / information on ingredients

Composition : Trade Secret	Ingredients ; Trade Secret

SECTION 4 – First Aid Measurers

Emergency and First Aid Procedures:

Ingestion: If ingested seek medical supervision.

Skin Contact: Wash skin with water and mild soap. If irritation occurs, seek medical attention.

Eye Contact: Flush eyes with plenty of water for 30 minutes. Get medical attention if warranted.

Inhalation: Remove to fresh air. Seek medical attention if irritation persists.

SECTION 5 – Fire – Fighting Measurers

Flash Point (Method Used): Not applicable

Flammable Limits: LEL – not applicable UEL – Not applicable

Special Fire Fighting Procedures: Wear proper fire - fighting equipment

Unusual Fire and Explosion Hazards: None

SECTION 6 – Accidental Release Measurers

Material is Released or Spilled: All spills should be contained and picked up with earthen or other absorbent material and placed in suitable container.

Waste Disposal Method: Follow Local, State, Federal regulations.

SECTION 7 – Handling and Storage

Precautions Handling and Storing: Spilled material may be slippery. Clean up spills completely before walking in the area of spillage.

Other Precautions: Follow Local, State and Federal regulations.

SECTION 8 – Exposure Control / Personal Protection

Personal Protective Equipment: Protective clothing, gloves and safety eyewear protection are not required, but recommended. Use appropriate NIOSH-approved respirator when needed. Respirator selection must be based on contamination levels found in the work area. Comply with OSHA standards 29 CFR 1910.134 Respiratory Protection and 29 CFR 1910.1000 Air contaminants Permissible Exposure Limits. Eyewash and Safety Shower should be available. Follow good housekeeping and manufacturing practices.

Ventilation: Use general or local exhaust ventilation to meet OSHA PELs or ACGIH TLV requirements.

SECTION 9 Physical and Chemical Properties

Boiling Point (F): Not Available	Specific Gravity (H₂O=1): ~ 1.275
Vapor Pressure (mmHg): Not available	Evaporation Rate (n-BuAc=1): Not available
Vapor Density (Air=1): Not available	Melting Point: Not available
Solubility in Water: Complete	pH: ± 6.0 – 8.5
Appearance and Odor: dark aqueous solution; sweet odor	

SECTION 10 – Stability and Reactivity

Stability: Stable

Conditions to avoid: None

Incompatibility: (Materials to Avoid): May corrosive to light metals.

Hazardous Decomposition Products: Thermal decomposition may produce oxides of carbon.

Hazardous Polymerization: Will not occur.

SECTION 11 Toxicological Information

Product Ingredients not listed in the National Toxicology Program (NTP) Report on Carcinogens or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs, or by OSHA.

Route(s) of Entry: Inhalation – none. Skin – unlikely. Eyes – yes. Ingestion – unlikely.

Carcinogenicity: NTP – no. OSHA –no.

Threshold Limit Value: See Section II

Acute Oral Toxicity (rat): Low acute oral toxicity; LD50 for rats is >5 g/kg.

Skin Contact: May cause irritation.

Eye Contact: May be irritating to eyes.

Inhalation: None

Effects of Overexposure: Acute signs and symptoms as listed.

SECTION 12 – Ecological Information

Non Mandatory – Regulated by Other Government Agency.

Investigate Local, State and Federal Regulations.

SECTION 13 – Disposal Considerations

Non Mandatory – Regulated by Other Government Agency.

Investigate Local, State and Federal Regulations.

SECTION 14 – Transportation Information

Non Mandatory – Regulated by Other Government Agency.

Investigate Local, State and Federal Regulations.

SECTION 15 – Regulatory Information

Non Mandatory – Regulated by Other Government Agency.

Investigate Local, State and Federal Regulations.

SECTION 16 – Other Information

SNI Solutions – SDS Document review and approval date: 06-23-14

The information contained herein is furnished without warranty of any kind. Employees should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.

Polk County Highway Department

F & A DAIRY SALT BRINE REPORT



**2008–2009
WINTER SEASON**

History:

During September 2008 I started working with Mike Breault and Chuck Engdahl from F & A Dairy in Dresser Wisconsin with the thought of using salt brine from their cheese making factory for snow and ice control. We were looking for a cost effective measure to reduce salt and salt sand use during the winter months. I toured the plant and collected several samples. F & A Dairy could supply up to 5000 gallons of salt brine a week to the Highway Department for snow and ice control. We could truck the material ourselves or have it delivered by a trucking company. F & A Dairy was willing to work with us and the DNR for testing the salt brine. The Dairy had send out samples for testing, see attached test results:

Once we had the test results back the concern was the high levels of BOD that came back 6050 mg/L to 7700 mg/L. I started contacting the DNR to get their concerns with using this product. Bob Garmer of the DNR told me that we would have to get a special Conditional Grant of Low Hazard Exemption Permit (see attached permit) to use the salt brine on the highways. A proposal was sent to the DNR on what highways we were going to use the material and the quantities that would be applied during a snow event. We received the permit in early January 2009.

Salt Brine:

Salt brine is usually made to 23.3 % salt by weight because this is the lowest freeze point for the salt brine. This is -6 degrees below zero. The salt brine from the dairy varied on each load from 25.5% to 24% salt by weight, with an average of 24.5% which would have a freeze point of 5.95 degrees according to the charts. During the winter I placed a 12 ounce container of the salt brine outside and found it did not freeze until we had two consecutive days of -21 degrees below zero.

Hauling:

Trucking the salt brine from the dairy to our highway shop in Balsam Lake was done both with a trucking company and our own tanker truck. The cost of the trucking company was 18 cents per gallon. If we hauled it ourselves we could bring the cost down to 8 - 9 cents a gallons. We stored the salt brine in two 6000 gallon poly tanks and then would fill each plow truck as needed. Before hauling the dairy would run the brine through a couple of filters to remove the whey solids and store in a separate tank.

Test Routes 1:

We started by testing with one state plow route, STH 46 from Balsam Lake to STH 35 and from Luck to the County line on STH 48. We also tested on one county plow route which included CTH V , CTH D from USH 8 To CTH G, CTH G from CTH E to the County Line, CTH T from USH 8 to CTH G and CTH E from STH 48 to CTH G (see attached map). The state plow route was using salt only and the county plow route was using a salt sand mix. Each route was also split so we could compare applications with the same truck. The county route used 30% salt sand mix and applied at a rate of 600 lbs per lane mile without salt brine and 400 lbs per lane mile with salt brine (see attached photos next page). The road temp was 22 degrees and the photos were taken on February 12, 2009 on CTH D and CTH E. The photos show using the salt brine was a 32% savings on material. The response time for the salt brine road showed that 15 minutes after application, the road was 50% clearer than the road without the salt brine. The state route with salt worked just as effective showing the salt brine aided in keeping the salt on the road and a quicker reaction time on clearing the roadway.

F & A Dairy Salt Brine Report
By Polk County Highway Department
April 2009



CTH D 2-12-09 400lbs per lane mile with 30% salt sand with Salt Brine



CTH E 2-12-09 600lbs per lane mile with 30% salt sand with out Salt Brine

Test Routes 2:

On February 16, 2009 I requested that the use of the salt brine be expanded to the northern half of the county by the DNR. This was granted (see attached map).

The next photos show a 40% reduction of material usage with road temps at 18 degrees and high winds. We found that a road temp of 10 degrees or higher would provide the fastest results. When the road temperature was below 10 degrees, the advantage was that it would still help the material from bouncing off the road. Once the road temp would come up to 10 degrees the melt was a fast process.

Salt Brine Test 2-18-2009 "Brine from F & A Dairy"



CTH E 500lbs per lane mile with out salt brine with 30% salt sand

F & A Dairy Salt Brine Report
By Polk County Highway Department
April 2009

Salt Brine Test 2-18-2009 "Brine from F & A Dairy"



CTH D 300lbs per lane mile with salt brine with 30% salt sand

Mixing:

I tried mixing the salt brine with Magnesium Chloride at rates of 25%, 50% and 75% salt brine to Mag. Chloride to lower the working temperature of the salt brine and to save money as the cost of the Mag. Chloride was \$1.30 a gallon. I found that the whey product would fall out of solution at each rate, causing the filters on the trucks to clog and the pumps to stop working. So you can not mix the salt brine from the cheese factor with Mag. Chloride.

Conclusions:

The tests showed that the use of the salt brine from F and A Dairy is a cost effective way to save money within our snow and ice control budget. Depending on the amount of material being applied, the material saved was 30% to 40%. Not only is there a material saving, but the quicker reaction time for the melt aids in clearing the highways. This is a win win for both our Polk County and F & A Dairy.

The roadways used for the test showed no sign of the salt brine residue this spring.



CTH D April – no signs of salt brine residue



CTH E April – no signs of salt brine residue

F & A Dairy Salt Brine Report
By Polk County Highway Department
April 2009

Attachments:

- Conditional Grant of Low Hazard Exemption Permit
- Test results on Salt brine from F & A Dairy
- Map of first test routes allowed
- Map of expanded test routes
- Salt brine fact sheet

Results compiled by:

Emil "Moe" Norby
Technical Support Manager
Polk County Highway Department
518 Main Street P.O. Box 248
Balsam Lake, WI 54810
715-485-8732



State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Matthew J. Frank, Secretary
John Gozdziwski, Regional Director

Northern Region Headquarters
107 Sutiliff Ave.
Rhinelander, Wisconsin 54501-3349
Telephone 715-365-8900
FAX 715-365-8932
TTY Access via relay - 711

December 30, 2008

Mike Breault
F & A Dairy Products, Inc.
PO Box 278
212 Hwy 35 S
Dresser WI 54009

Polk County
SW APP

Subject: Conditional Grant of Low Hazard Exemption
Use of Waste Salt Brine as a De-icing Agent on Polk County Roadways

Dear Mr. Breault:

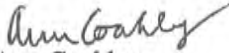
The Department received proposals for the use of waste salt brine liquid from F & A Dairy Products, Inc., Dresser, Wisconsin, as a pre-wetting agent for sand and salt on Polk County roads. The brine solution is proposed to be tested by the Polk County Highway Department as an activator to speed up the effectiveness of salt on roadways during snow plowing operations on select roadways in the county during the 2008-2009 winter driving season. Your proposals were received by the Department on December 5, 2008, and December 16, 2008. A plan review fee for this low hazard exemption project is waived.

The Polk County Highway Department proposes to use eight gallons of waste salt brine liquid for every ton of salt or sand used. The test highways within the County include two state highways and several county highways as designated in the attached low hazard exemption.

Based on our review, the Department has determined that your plan is consistent with the low hazard exemption requirements in s. NR 500.08(4), Wis. Adm. Code, and s. 289.43(8), Stats. Therefore, the use of waste salt brine liquid from F & A Dairy Products, Inc., in Dresser WI as a pre-wetting agent to be used by the Polk County Highway Department during the 2008-2009 winter driving season is granted a low hazard waste exemption in accordance with ch. 289, Stats. and chs. NR 500-538, Wis. Adm. Code, subject to the conditions in the attached approval.

You are reminded that approval by the Department does not relieve you of your obligation to meet all other applicable state and local permits, zoning and regulatory requirements. If you have any questions regarding this matter, please contact Bob Germer, Waste & Materials Management Specialist, at (715) 635-4060.

Sincerely,



Ann Coakley
Waste and Materials Management Program Supervisor
Northern Region

Att.

Cc: Bob Germer - Spooner
Emil Norby, Polk County Highway Department, PO Box 248, 518 Main Street, Balsam Lake WI
54810
Bob Grefe - WA/5
Kathy Bartilson - Spooner
Pete Prusak - Cumberland

BEFORE THE
STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

CONDITIONAL GRANT OF EXEMPTION
USE OF WASTE SALT BRINE LIQUID FROM CHEESE PRODUCTION
AS A DE-ICING AGENT
ON SELECTED STATE AND COUNTY HIGHWAYS IN POLK COUNTY WISCONSIN

FINDINGS OF FACT

The Department finds that:

1. F & A Dairy Products, Inc., submitted a low hazard exemption request, dated November 26, 2008, to the Department on December 5, 2008, for the use of waste salt brine liquid from their cheese manufacturing process as a de-icing agent and activator for use by the Polk County Highway Department on selected state and county roads. The plan review fee was waived as a discretionary decision due to the short time interval for conduct of the proposed operation and to encourage the generation of experience and data that would justify a land application proposal for a longer time interval under NR 518, Wis. Adm. Code.
2. The purpose of the request is to test this material as an economical alternative and supplement to commercially available road de-icers during the 2008-2009 winter driving season.
3. The waste salt brine liquid from F & A Dairy Products, Inc., is the result of the ultra-filtration (UF) of the brine water used for cooling the cheese and transferring salt into the cheese.
4. F & A Dairy Products, Inc., produces 3,000 to 5,000 gallons of waste salt brine liquid per week from their operations. Waste salt brine liquid not used for road application as a de-icer will be managed through the existing WPDES permit # WI-0054852-05-0
5. The outflow from F & A Dairy Products, Inc.'s ultra-filtration system produces a liquid containing approximately 17% salt, less than 0.10% protein, a pH between 5.2-5.5 and a BOD in the range of 6000 to 8000 mg/l. So far as is known, the salt brine does not contain synthetic organic compounds or solvents, volatile organic compounds, or semivolatile compounds from any other source than food processing operations.
6. Polk County Highway Department intends to use eight gallons of the F & A Dairy Products, Inc., waste salt brine liquid per one ton of salt or sand used.
7. The normal road salt application rates used by the Polk County Highway Department are 200 pounds of salt per lane mile and 400 pounds of salt per lane mile depending upon the intensity of the winter storm and the existing temperature.
8. Following the mix rate of eight gallons of waste salt brine liquid per ton of salt or sand, this calculates out to 0.8 gallons of waste salt brine liquid per lane mile at a rate of 200

pounds of salt per lane mile and 1.6 gallons of waste salt brine liquid per lane mile at a rate of 400 pounds of salt per lane mile.

9. The Polk County Highway Department emailed a memo and map to the Department on December 16, 2008, showing the designated road sections to be used during the test with this de-icer. The road sections and other information from the County are as follows:
 - a. One state highway plow route that runs on State Highway 46 from Balsam Lake north to the intersection with Hwy 35 just east of Milltown and continues on
 - b. State Highway 48 from Luck east to the Barron County line.
 - c. One county highway route which will include CTH V, CTH D from USH 8 to CTH G, CTH G from CTH E to the County Line, CTH T from USH 8 to CTH G and CTH E from STH 48 to CTH G.
 - d. A map was submitted to the Department from the Polk County Highway Department on December 16, 2008, showing the designated road sections to be used for the test. The roads are highlighted in red.
 - e. The waste salt brine liquid will be stored at the Polk County Highway Shop upon receipt from F & A Dairy, Inc.
10. Additional facts relevant to the review of the exemption request include the following:
 - a. The inorganic fraction of the salt brine consists of conventional salt compounds that are similar or identical to road salt and anti-ice compounds currently used on paved roads.
 - b. The organic fraction of the salt brine consists of small amounts of fats and other organic compounds resulting from the cheese-making operation that generated the salt brine.
 - c. The Department has determined that the application rates of both the inorganic fraction and the organic fraction of the salt brine is not likely to have any incremental effect on runoff or roadside soil quality beyond that exerted by current road maintenance operations.
 - d. Salt brine from cheesemaking will displace salt brine generated by the Polk County Highway Department for use in road-salting operations during winter months to reduce loss of granular salt to unpaved shoulders and increase adhesion to the paved surface.
11. If the conditions set forth below are complied with, the proposal will meet the requirements of NR 500.08(4), Wis. Adm. Code, and s. 289.43(8), Stats.

CONCLUSIONS OF LAW

1. Based on the foregoing, the Department has the authority under subs. 289.43 (8), Stats., and sub. NR 500.08(5), and NR 518.04(7) Wis. Adm. code to issue a grant of exemption if the exemption would not inhibit compliance with the applicable provisions of ch. 30, 31, 160, and 280 to 299 and ss. 1.11, 23.40, 59.692, 59.693, 60.627, 61.351, 61.354, 62.231, 62.234, and 87.30, Stats.
2. The Department has authority to approve a grant of exemption with conditions if the conditions are needed to ensure compliance with the applicable provisions of ch. 30, 31, 160, and 280 to 299 and ss. 1.11, 23.40, 59.692, 59.693, 60.627, 61.351, 61.354, 62.231, 62.234, and 87.30, Stats.
3. The conditions set forth below are needed to ensure compliance with the applicable provisions of ch. 30, 31, 160, and 280 to 299 and ss. 1.11, 23.40, 59.692, 59.693, 60.627, 61.351, 61.354, 62.231, 62.234, and 87.30, Stats.
4. In accordance with the foregoing, the Department has the authority under sub. 289.43 (8), Stats. and sub. NR 500.08(5) Wis. Adm. Code to issue the following conditional grant of exemption.

CONDITIONAL GRANT OF EXEMPTION

The Department hereby grants a low hazard exemption to F & A Dairy Products, Inc., for the use of waste salt brine liquid by the Polk County Highway Department as a de-icing agent for roadways in Polk County during the 2008-2009 winter driving season. The following conditions to this grant of exemption apply:

1. This conditional grant of exemption applies to the use of waste salt brine liquid as a de-icing agent on designated Polk County Highways during the 2008-2009 winter driving season only.
2. Use of salt brine on State and County Highway segments other than those designated in the December 16, 2008, memo and attached map from the Polk County Highway Department shall be identified in a letter or email to the Department at the start of use.
3. Waste salt brine liquid that is not used by the Polk County Highway Department shall be managed following the conditions of WPDES permit # WI-0054852-05-0 or other approved discharge permit requirements.
4. A report shall be submitted to the Department by April 1, 2009, that summarizes the volume of waste salt brine liquid used on each of the test roadways, the effectiveness of using this waste as an alternative de-icer and any recommendations from the County on long term use of the material.
5. Continued use of salt brine from cheesemaking operations by the Polk County Highway Department or other agencies shall be conducted under approval of a land application plan proposed in accordance with NR 518, Wis. Adm. Code.

The Department retains the jurisdiction either to require submittal of additional information or to modify this approval at any time if, in the Department's opinion, conditions warrant further modifications. Enforcement discretion may apply if the conditions of this grant of exemption are not followed.

NOTIFICATION OF APPEAL RIGHTS

If you believe you have a right to challenge this decision made by the Department, you should know that Wisconsin statutes, administrative codes and case law establish time periods and requirements for reviewing Department decisions.

To seek judicial review of the Department's decision, sections 227.52 and 227.53, Stats., establish criteria for filing a petition for judicial review. Such a petition shall be filed with the appropriate circuit court and shall be served on the Department. The petition shall name the Department of Natural Resources as the respondent.

Dated: DEC 30 2008

DEPARTMENT OF NATURAL RESOURCES
For the Secretary

Ann Coakley
Ann Coakley
Waste & Materials Management Program Supervisor
Northern Region

Robert Gemmer
Robert Gemmer
Waste & Materials Management Specialist
Northern Region



Commercial Testing Laboratory, Inc.

514 Main Street P.O. Box 526 Colfax, Wisconsin 54730
Phone: 715-962-3121 Phone: 800-962-5227 Fax: 715-962-4030

ANALYTICAL REPORT

F & A Dairy-Dresser
Hwy 35
PO Box 278
Dresser WI 54009

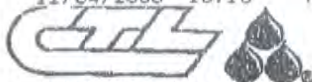
Report Number: 08024855 Page: 1
Report Date: 9/30/08
Date Received: 9/24/08

Sample Number	Sample ID	Test	Results	Method	LOD/LOQ	Date Analyzed
08-W28765	Brine	BOD (5 Day), mg/L	7,700	SM5210B		9/24/08
	9/24/08	pH (Lab)	5.3	SM4500H+		9/24/08
		Protein (Kjeldahl), %	0.10			9/25/08

RESULTS: _____
FAX'D ON: 9-30-08
PHONED ON: _____
CALLER: _____

WI DNR Laboratory Certification Number: 617013980

Approved by: *11*



WWW.CTLCOFAX.COM

Commercial Testing Laboratory, Inc.

514 Main Street
Phone: 715-962-3121

P.O. Box 526
Phone: 800-962-5227

Colfax, Wisconsin 54730
Fax: 715-962-4030

ANALYTICAL REPORT

F & A Dairy-Dresser
Hwy 35
PO Box 278
Dresser WI 54009

Report Number: 08027998 Page: 1
Report Date: 11/4/08
Date Received: 10/29/08

Sample Number	Sample ID	Test	Results	Method	LOD/LOQ	Date Analyzed
08-W32373	UF Brine 10/28/08	BOD (5 Day), mg/L	6,050	SMS210B		10/29/08
		Chloride, %	17.6			10/29/08
		pH (Lab)	5.2	SM4500H+		10/29/08
		Protein (Kjeldahl), %	0.05			11/3/08

Filtered

@ 5000 GALLONS PER WK

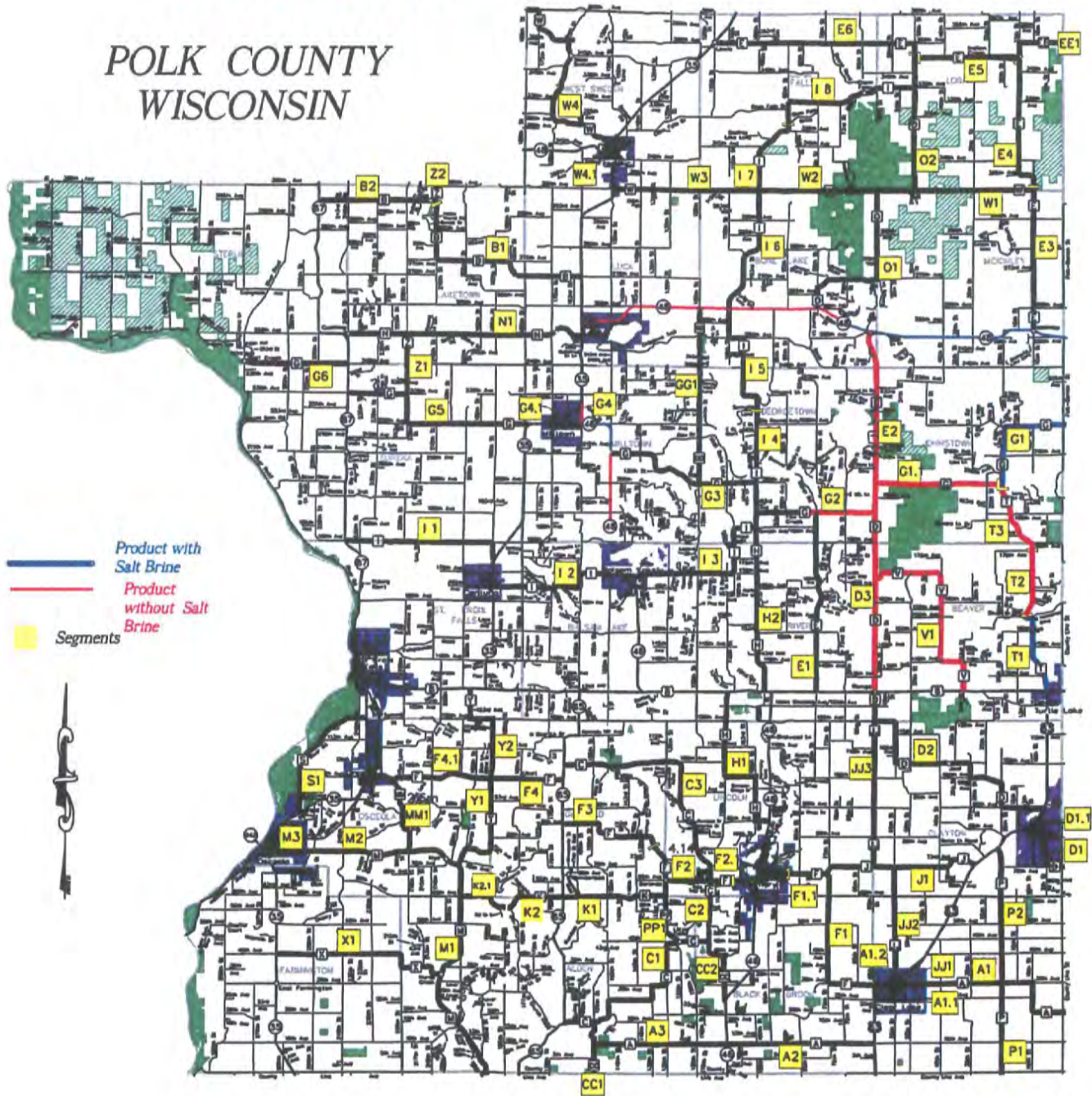
RESULTS: _____
FAX'D ON: 11-4-08
PHONED ON: _____
CALLER: _____

WI DNR Laboratory Certification Number: 617013980

Approved by: 11

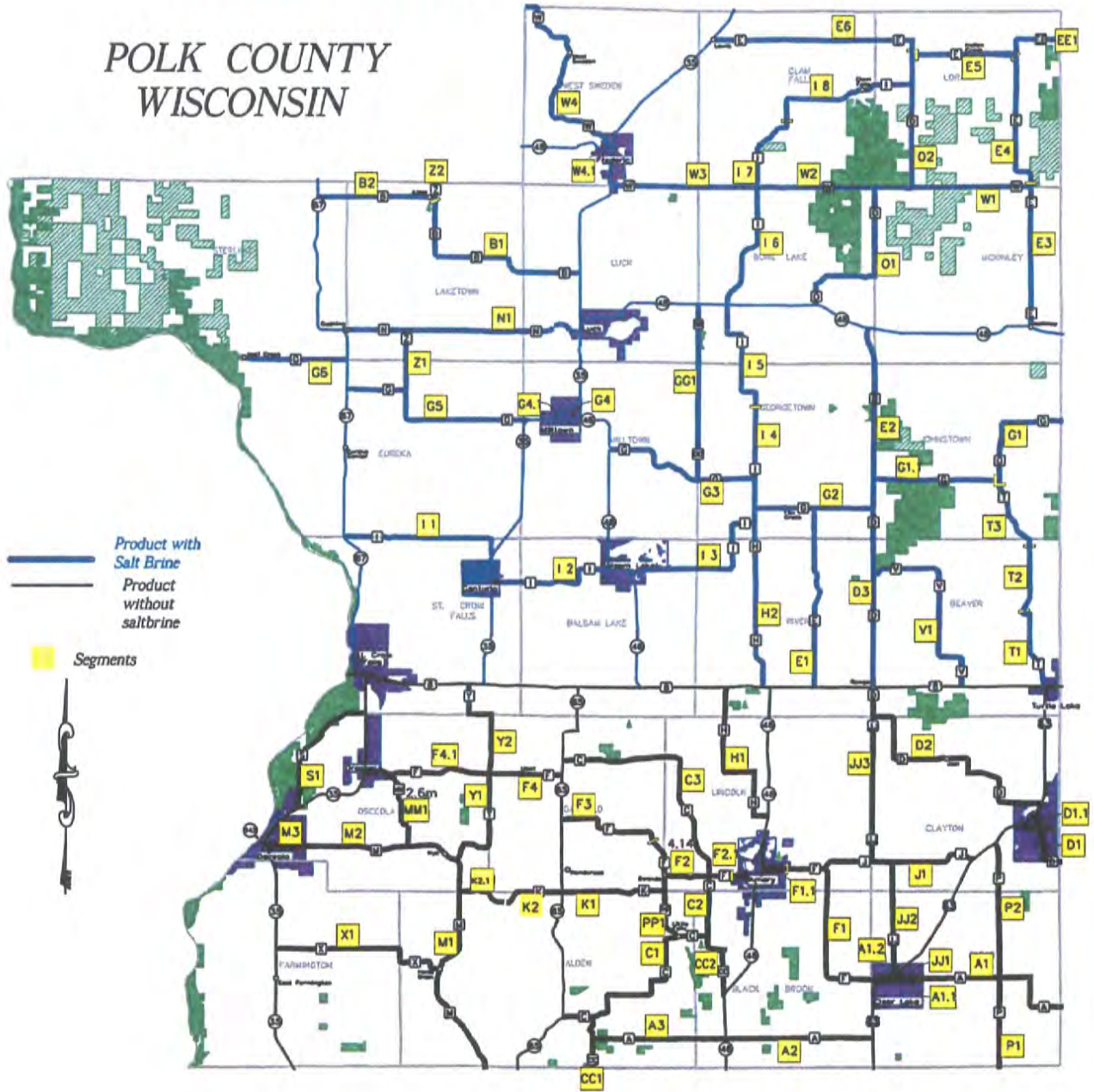
First Salt Brine Test Routes 2008-2009

POLK COUNTY
WISCONSIN



Expanded Salt Brine Test Routes 2008-2009

POLK COUNTY
WISCONSIN



Salt Brine Statistics And Rock Salt

Salt brine Eutectic 23.3% @ 59°F

Salt brine specific gravity at 23.3% 59°F = 1.179

Pounds of salt per gallon of brine 2.28 pounds @ 23.3% @ 59°F

Salt weight per cubic foot ASTM spec D 632 approximately 80 Pounds

Salt weight per Cubic Yard ASTM spec D 632 approximately 2,160 Pounds

FREEZING POINT OF SALT BRINE BY % OF WEIGHT

% Of NaCl By Weight	Spec Gravity 15°C - 59°F	Freeze Point °C	Freeze Point °F
0	1.000	0.00	32.0
1	1.007	-0.58	31.0
2	1.014	-1.13	30.0
3	1.021	-1.72	28.9
4	1.028	-2.35	27.8
5	1.035	-2.97	26.7
6	1.043	-3.63	25.5
7	1.051	-4.32	24.2
8	1.069	-5.03	22.9
9	1.027	-5.77	21.6
10	1.074	-6.54	20.2
11	1.082	-7.34	18.8
12	1.089	-8.17	17.3
13	1.097	-9.03	15.7
14	1.104	-9.94	14.1
15	1.112	-10.88	12.4
16	1.119	-11.90	10.6
17	1.127	-12.93	8.7
18	1.135	-14.03	6.7
19	1.143	-15.21	4.6
20	1.152	-16.46	2.4
21	1.159	-17.78	0.0
22	1.168	-19.19	-2.5
23	1.176	-20.69	-5.2
23.3 (E)	1.179	-21.13	-6.0
24	1.184	-17.0	-1.4
25	1.193	-10.4	13.3
26	1.201	-2.3	27.9
26.3 (S)	1.203	0.0	32.0

POUNDS OF ICE MELT PER POUND OF SALT

Temperature In Degrees F	One Pound of Sodium Chloride (salt)
30	46.3 lbs of ice
25	14.4 lbs of ice
20	8.6 lbs of ice
15	6.3 lbs of ice
10	4.9 lbs of ice
5	4.1 lbs of ice
0	3.7 lbs of ice
-6	3.2 lbs of ice

E = Eutectic Point
S = Saturation Point

Eutectic Point = the % of weight, which a chemical solution has the lowest freeze point.

Saturation Point = the point which water will no longer receive no more of another substance in a chemical solution or combination.

Green Earth Super Brine

Enhanced Liquid Salt Brine



Salt Brine is sodium chloride in liquid form.

BEST USES:

- As a proactive approach, used as an anti-icer before the snow event
- As a de-icer after snow removal, apply to the ice that has bonded to the pavement surface underneath
- As a pre-wetting treatment to standard granular rock salt spreading

BENEFITS of Green Earth Super Brine

- Brine is enhanced with our Salt Saver™, which is a liquid treatment that significantly reduces the amount of salt required to effectively de-ice your location
- Salt Saver, with a freezing point of -60°C , is added to the salt brine to bring working temperatures way down, and to increase the performance and longevity, beyond other brines. It also lowers the potential of black ice from forming.
- Very fast acting. Granular de-icers have to dissolve first into liquid, where as liquid brine works on contact.
- Less applications are needed, reducing labor costs
- Non-tracking, safer for the environment, safer for plants & vegetation, and less corrosive due to Salt Saver's corrosion inhibitors
- Green color that is photosensitive and non-staining, it fades with light
- Does not contain beet juice or any other waste bi-products

APPLICATION

- As an ANTI-ICER: approx $\frac{1}{2}$ gallon per 1000 Square Feet
- As a DE-ICER: approx 1-3 gallons per 1000 Square Feet, depending on ice thickness

(SAFE – Low Cost)

The Green Earth Company, Inc. – 1-800-528-1922

www.TheGreenEarthCo.com