Ahead of the Pack

By Connie Forten of Forten Consulting

As budgets tighten but the demand for high levels of service increase, the snow and ice management industry is stressed to do more with less. We no longer have the luxury of time to melt from the "top down"—a slow and expensive process, both economically and environmentally. Our melting should be targeted at the pavement surface. Anti-icing—"bottom up" melting—will weaken the bond between ice and pavement, and allow quicker success in snow removal.

Which of the following proactive steps can you incorporate into your snow and ice management plan? Whatever you decide, make sure it is documented in your winter maintenance policy—and

that both your crew and clients are informed.

Anti-icing in advance of the storm. By monitoring the weather and applying a small amount of liquid deicer before the snow, the bond between the snow and pavement will be weak. Plowing will be more successful, and the amount of chemicals needed to hold the site post-storm will be reduced. Liquid de-icers, although commonly chloride-based, are 70% to 80% water. Any time a liquid product can be used instead of or to reduce the amount of granular product, it will speed up operations. It will also lower the total amount of salts applied and help protect our water.

Aggressive mechanical removal starting at the first snowfall. If you have a 2-in. trigger policy, you may arrive and the snow has already been driven on and is compacted. Long hours of scraping and salting are needed. The best policies synchronize mechanical removal with the start of a storm. With a proactive plowing policy, more time will be spent plowing in the beginning, but less time and chemicals will be needed in the long run.

Smart location of snow piles. Snow piles are full of salt and debris. You cannot recover the salt, but you can recover the debris. Place piles on a hard surface that can be swept in the spring. Do not use grass areas, ponds or wetland for snow storage. Consider the location and slope of the storage site. Can you place the pile where snowmelt will not run across the parking lot, causing refreeze problems? Property assessment. Persistent ice slicks or trouble spots, often on sidewalks, are caused by poor drainage. Document these areas and discuss them with your client. Repairing these problems in the summer can help lower the risk for slip and falls.

Education. As our tools and techniques change, invest time in educating your clients and your crew. Help them understand new reasons and practices for being proactive. People are more comfortable with what they have done or seen for years. New practices shouldn't just appear—they should be explained upfront, managing everyone's expectations for a smooth complaint-free winter season.

Our winter maintenance practices over the past 50 years have accelerated the amount of salt entering our freshwater systems. Although salt is a useful, affordable de-icer, it is a permanent pollutant to our freshwater systems. We should challenge ourselves to manage snow and ice most efficiently with the least amount of salt. In the cold-weather states, lakes, rivers and aquifers are showing increased salinity. By integrating proactive practices into your operations, you will help your customer, your business and our lakes and rivers.

Pre-treatment will make your life easier and surfaces safer for your patrons.
photo, Ken Rost

Freezing Rain Adds to the Headache!

By Dale Keep, Ice and Snow Technologies

In the snow and ice management business, freezing rain is normally the most difficult form of precipitation to deal with because of the large amount of moisture and the extremely high rates of dilution for deicing chemicals applied. While the resulting ice layer resembles a black ice condition, it is different in that there is a continuous addition of ice to the surface.

During severe storms, continuous deicer applications are often applied (often without success) in an attempt to stay ahead of the ice. Given this tactic, contractors must consider the level of service requirements of the contract and the amount of ice expected while developing a plan. Due to the high rate of dilution to the deicer(s) applied during the freezing rainstorm, typically large amounts of deicers are required to maintain or often regain bare, wet conditions.

Freezing rain scenariosFreezing rain falls on clear, dry pavement. Under this scenario, a liquid pretreatment is a good start. It will slow the development of ice on the surface and may give you time to mobilize and reapply before ice formations start. Retreat as necessary with dry or pre-wetted solid deicers to maintain or achieve the desired level of service.

Freezing rain falls on snow- or ice-covered pavement. Under these conditions, if quick removal is desired, a heavy application of dry or pre-

wetted solid chemical is needed ahead of the freezing rain. This would be followed by further treatment as necessary with dry or pre-wetted solid deicers. In extreme freezing rainstorms, a combination of deicers and plows may be needed to remove the ice when the storm is over.

A difficult task

In addition to the high dilution rate and large quantities of deicers typically required to battle freezing rain, there is a high risk of melt and refreeze, unless the storm ends with the surface temperatures rising.

Predicted storm severity, time of day, deicer availability, inventory, cost of multiple applications, customer expectations, and the reality of the situation should all be considered when developing a storm-fighting strategy.

In severe storms, when ice forms and the storm continues, there is a high probability that it may not be possible to manage it with chemicals. I have experienced ice storms during which we started out using chemicals only to be forced to park equipment until the storm was over. Regardless of the approach to control it, freezing rain is the ultimate challenge; and there may be times—regardless of contract or intentions—when reality will dictate the ultimate plan and the results.

What's the difference?

Recently while sitting in an airport,

people were talking about freezing rain and what to do as a homeowner and a driver. It quickly became clear that they were not talking about freezing rain, but rather were talking about ice pellets or sleet. This common misconception, and the difficulty in managing different precipitation, makes the subject worthy of some definitions:

Snow. Solid precipitation in the form of minute ice flakes that occur below freezing.

Snow pellets (graupel). White, opaque, approximately round ice particles between 2 and 5 mm in diameter that form in a cloud either from ice crystals sticking together or from accretion (the growth or enlargement by gradual buildup).

Ice pellets (sleet). Transparent pellets of ice that measure 5 mm or less in diameter.

Freezing rain/drizzle. Rain or drizzle that falls in liquid form and then freezes upon striking a cold object or ground. Both can produce a glaze coating of ice. Freezing rain is the result of warm air sandwiched between layers of cold air.

The thickness of the warm air layer will dictate which form of precipitation formed:

If the warm air layer is thin or nonexistent, precipitation will start as and remain snow.

A warm air layer that is somewhat thicker will allow snow to partially melt and refreeze as snow pellets.

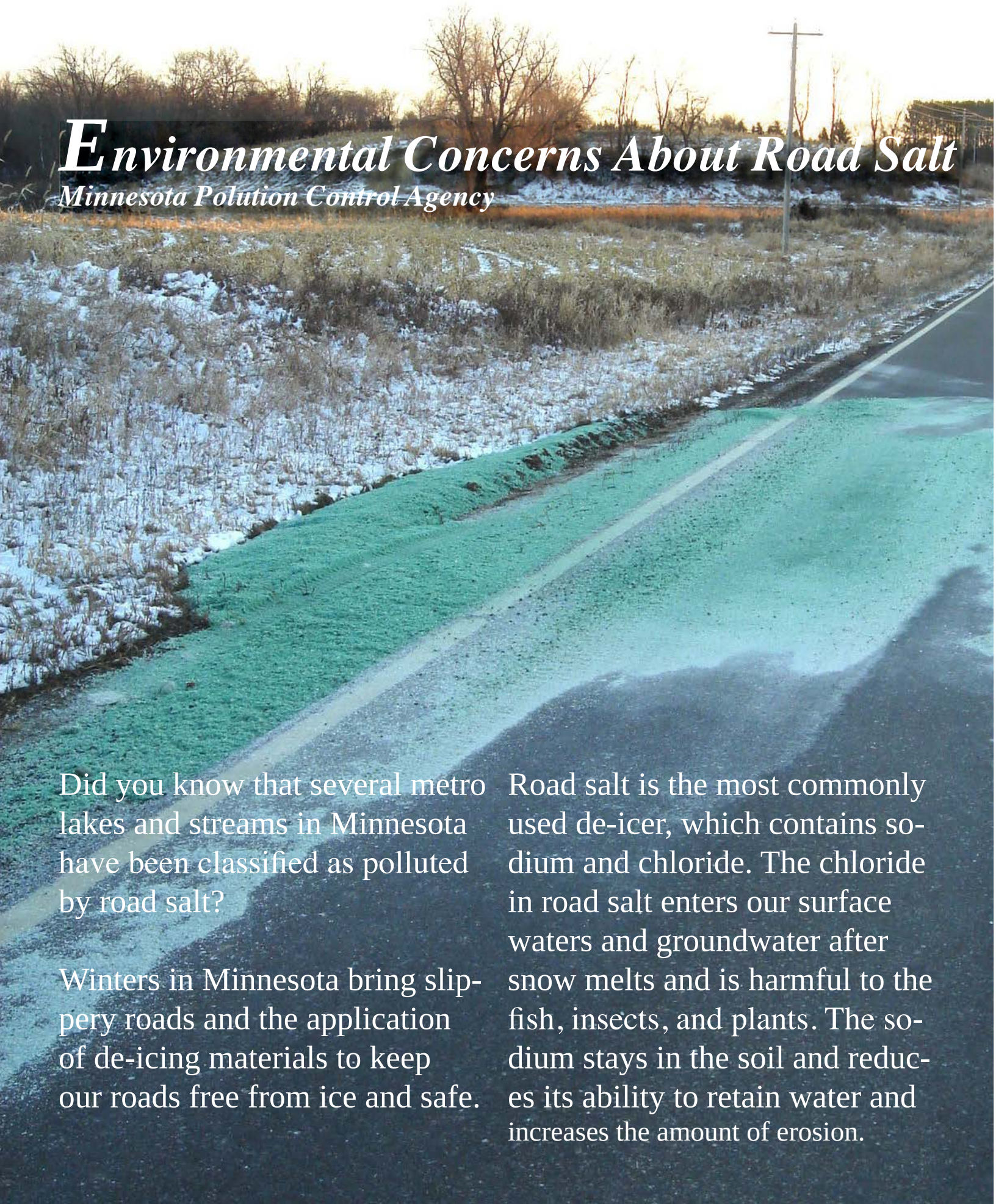
As the warm air layer thickens, snowflakes will almost completely melt and then fall into a thick layer of cold air resulting in sleet. When the warm air layer is thick enough to fully melt the snow and the lower cold air layer causes the water droplets to become super-cooled, the rain freezes when it strikes the ground. It can also be the case that the ground is still frozen, which will give the same effect—a layer of clear ice.

The record depth for freezing rain is at 8 inches, set in Idaho in January 1961.

Dale Keep owns Ice & Snow Technologies, a training and consulting company based in Walla Walla, WA.

Environmental Concerns About Road Salt

Minnesota Polution Control Agency



Did you know that several metro lakes and streams in Minnesota have been classified as polluted by road salt?

Winters in Minnesota bring slippery roads and the application of de-icing materials to keep our roads free from ice and safe.

Road salt is the most commonly used de-icer, which contains sodium and chloride. The chloride in road salt enters our surface waters and groundwater after snow melts and is harmful to the fish, insects, and plants. The sodium stays in the soil and reduces its ability to retain water and increases the amount of erosion.

Too much salt results in costly damages and serious environmental consequences.

While progress in Minnesota has been made in these areas, there is still much work to do in order to meet water quality standards and achieve a high level of road safety. In 2010, the MPCA more than doubled the number of waters that are listed as impaired for chloride.

A study conducted by the University of Minnesota determined a chloride mass balance for the Twin Cities Metropolitan Area (TCMA) and found that approximately 78% of all chloride generated in the TCMA is being retained in the TCMA. This includes all of the main sources of chloride: chloride from road salt, wastewater treatment plants, water softeners, and other industrial sources.

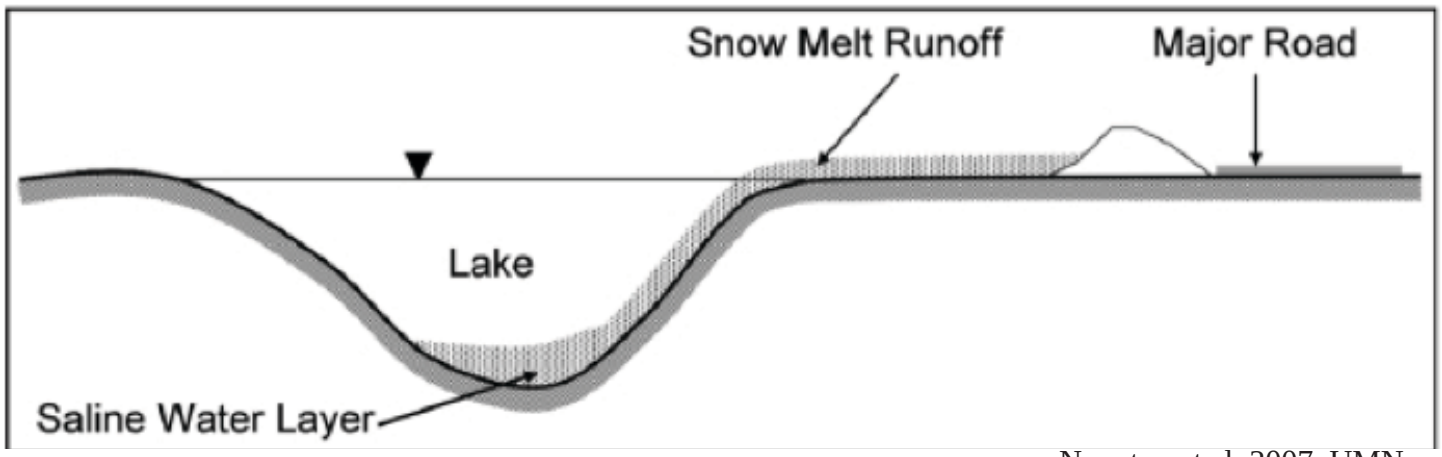
Chloride is a conservative ion (meaning it moves with water without being broken down or lost). Once the chloride is in the water, the only known technology for its removal is reverse osmosis through massive filtration plants, which is not economically feasible. This means that chloride will continue to accumulate in the environment. A high chloride concentration in both the aquatic and terrestrial environment has some of the following implications for human consumption, aquatic life, and plant life:

- At high concentrations chloride is toxic to fish and insects
- At lower levels chloride can negatively affect the fish and insect community structure, diversity and productivity
- Direct road salt splash can kill plants
- Sodium in the road salt destroys soil stability, decreases the soils ability to infiltrate water, and can increase soil erosion.
- Some animals living near or relying on chloride polluted waters are sensitive to road salt

While research does exist that identifies the negative impacts that chloride and specifically road salt has on the environment, there are still many unknowns. Continued research will help us to better understand how chloride interacts with the environment and therefore how to properly manage our water resources.

Follow these simple tips to protect our water!

There are many ways to reduce salt use while maintaining high safety standards.



Novotny et al. 2007, UMN

- Shovel. The more snow and ice you remove manually, the less salt you will have to use and the more effective it can be. Whether you use a shovel, snow blower, snow plow, or ice scraper, get out there as early as you can and keep up with the storm. You may even decide that salt isn't needed.
- 15°F is too cold for salt. Most salts stop working at this temperature. Use sand instead for traction, but remember that sand does not melt ice. Use the reference table below to apply the correct product for the conditions.
- Slow down. Drive for the conditions and make sure to give plow drivers plenty of space to do their work.
- Be patient. Just because you don't see salt on the road doesn't mean it hasn't been applied. These products take time to work.
- More salt does not mean more melting. Use less than 4 pounds of salt per 1,000 square feet (an average parking space is about 150 square feet). One pound of salt is approximately a heaping 12-ounce coffee mug. Consider purchasing a hand-held spreader to help you apply a consistent amount.
- Sweep up extra. If salt or sand is visible on dry pavement it is no longer doing any work and will be washed away. Use this salt or sand somewhere else or throw it away.
- Watch a video. This video, produced by the Mississippi River Watershed Management Organization, provides tips to homeowners about more environmentally friendly snow and ice removal: Improved Winter Maintenance: Good Choices for Clean Water. http://www.youtube.com/watch?v=qc8Y-_Nmfmo
- Share a brochure. Read and pass along Nine Mile Creek Watershed District's brochure about residential snow and ice care. You can find it on Nine MIle Watershed District's education page. http://www.ninemilecreek.org/EDUCATION/EducationPrograms.asp

- Check out other resources. If you are responsible for snow and ice removal somewhere other than your home, please check out our training and resources tab.

Know about the salt product

Salts can range from simple table salt to calcium chloride. Salts are used because they are able to decrease the freezing point of water. Whatever product you chose, make sure you know at what temperature it stops working. We recommend using the table below as labels may be misleading. Note that pavement temperatures are usually warmer than air temperatures. To find out the pavement temperature near you, search the Road Weather Information Service, http://www.rwis.dot.state.mn.us/.

Calibrate your equipment and know where you are applying your snow and ice removal chemistries. ***photo Ken Rost***

Winter Parking Lot and Sidewalk Maintenance

Key Information Needed:

- Pavement Temperature (it will be different than air temperature)
- Parking lot area (or drive lane distance) = Length x Width
- Amount of material your truck or sander delivers at each setting and speed.

Use less! About one tsp. of salt contaminates 5 gallons of water.

TIPS:

- De-icers melt snow and ice. They provide no traction on top of snow and ice.
- Anti-icing prevents the bond from forming between pavement and ice.
- De-icing works best if you plow before applying material.
- Pick the right material for the pavement temperatures.
- Sand only works on top of snow as traction. It provides no melting.
- Anti-icing chemicals must be applied prior to snow fall.
- NaCl (road salt) does not work on cold days, less than 15º F.

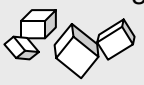
Help protect our lakes, streams, wetlands, and drinking water!

Use best practices for winter maintenance.

Melt Times for Salt (NaCl) at Different Pavement Temperatures

Pavement Temp. ºF	One Pound of Salt (NaCl) melts	Melt Times
30º	46.3 lbs of ice	5 min.
25º	14.4 lbs of ice	10 min.
20º	8.6 lbs of ice	20 min.
15º	6.3 lbs of ice	1 hour
10º	4.9 lbs of ice	Dry salt is ineffective and will blow away before it melts anything

Pick your material based on lowest practical melting temperature, not eutectic temperature which is often listed on the bag.



Melting Characteristics	
Chemical	**Lowest Practical Melting Temp.**
$CaCl_2$ (Calcium Chloride)	-20º F
KAc (Potassium Acetate)	-15º F
$MgCl_2$ (Magnesium Chloride	-10º F
NaCl (Sodium Chloride)	15º F
CMA (Calcium Magnesium Acetate)	20º F
Blends	Check with manufacturer
Winter Sand/Abrasives	Never melts—provides traction only

Variables affecting application rate

Increase rate:	*Decrease Rate:*
Compaction occurs & cannot be removed mechanically	Light snow or light freezing rain
There is a lot of snow left behind	Pavement temperature is rising
	Subsequent applications

Minnesota Pollution Control Agency

FORTIN CONSULTING, INC. serving the environment

CTAP Circuit Training and Assistance Program

ENVIROTECH SERVICES, INC.

UNIVERSITY OF MINNESOTA

minnetonka

Minnesota Department of Transportation

Cadwell Lawn Care & Landscaping

Scott Celebrating 150 Years

LTAP Minnesota Local Technical Assistance Program

GGP General Growth Properties, Inc.

October 2010 revision File available at www.pca.state.mn.us/roadsalt

Deicing Application Rate Guidelines for Parking Lots and Sidewalks

These rates are adapted from road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates using the guidelines as a starting point and modify them incrementally over time to fit your needs. The area should first be cleared of snow prior to applying chemical.

Pavement Temp. (ºF) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate in lbs. per 1000 square foot area			
			Salt Prewetted/ Pretreated With Salt Brine	Salt Prewetted/ Pretreated With Other Blends	Dry Salt	Winter Sand (abrasives)
>30º↑	Snow	Plow, treat intersections only	0.75	0.5	0.75	not recommended
	Frz. Rain	Apply chemical	1.25	1.0	1.5	not recommended
30º↓	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.5	1.25	1.75.	not recommended
25 - 30º ↑	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.5	1.25	1.75	not recommended
25 - 30º ↓	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.75	1.5	2.25	3.25
20 - 25º ↑	Snow or Frz. Rain	Plow & apply chemical	1.75	1.5	2.25	3.25 for frz. rain
20 - 25º ↓	Snow	Plow & apply chemical	2.0	2.0	2.75	not recommended
	Frz. Rain	Apply chemical	2.5	2.0	3.0	3.25
15º to 20º ↑	Snow	Plow & apply chemical	2.0	2.0	2.75	not recommended
	Frz. Rain	Apply chemical	2.5	2.0	3.0	3.2
15º to 20º ↓	Snow or Frz. Rain	Plow & apply chemical	2.5	2.0	3.0	3.25 for frz. rain
0 to 15º ↑ ↓	Snow	Plow, treat with blends, sand hazardous areas	not recommended	3.0	not recommended	5.0 spot treat as needed
< 0º	Snow	Plow, treat with blends, sand hazardous areas	not recommended	4.5	not recommended	5.0 spot treat as needed

To determine the amount of material needed, take the application rate x parking lot area / 1000 ft^2 . ***Example:*** Given a 300,000 sq. ft. parking lot and an application rate of 1.5 lbs/1000ft^2 1.5 x 300,000 = 450,000 450,000/1000 = 450 lbs (nine 50 lb. bags).

Anti-Icing Guidelines

These are a starting point only. Adjust based on your experience.

Condition	Gallons/1000 sq. ft.		Other Products
	$MgCl_2$	Salt Brine	
1. Regularly scheduled applications	0.2 - 0.4	0.3 – 0.6	Follow manufacturers' recommendations
2. Prior to frost or black ice event	0.2 - 0.4	0.3 – 0.6	
3. Prior to light or moderate snow	0.2 - 0.4	0.3 – 0.8	

CAUTION: Too high an application rate may result in slippery conditions or tracking.