Optimize Your Sidewalk Ice Melting Program to Improve Winter Safety and Meet the Challenges of Today's Business Climate

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Preventing winter slip and fall accidents has never been more important for building owners, facility managers and maintenance contractors responsible for keeping walkways free of snow and ice. The cost of effective deicing materials and time spent maintaining safe walks, steps and entryways is minor compared to the risks associated with slippery walkways and the damage it can inflict on businesses.

Today, the need for safety must be balanced with other important business considerations, including the cost-efficiency of deicing operations and their impact on walkways, buildings and landscape. Also important are society's rising expectations for facility owners, managers and contractors as concerns about human health, accessibility, and environmental impact become more widespread. More responsible and improved snow and ice control practices are among the ways facilities are responding to meet the entire range of requirements.

The Business Case for Effective Ice Melting

There are many business reasons to effectively control snow and ice on walkways, stairs, landings and other outdoor surfaces:

Minimizing Slip/Fall Liability

A disciplined snow and ice control program can protect facility owners from costly litigation. According to the National Floor Safety Institute, the average cost of a worker compensation claim for a slip and fall accident is $4,000. When customers or third parties are involved, liability awards quickly jump, averaging $60,000 to $100,000 per claim. Legal costs, lost productivity and human suffering can make the final toll from these accidents much higher.

Complying with Local Regulations

In many communities, clearing and maintaining safe sidewalks are the responsibility of the property owner and regulations often define how quickly sidewalks and other public walkways must be cleared of snow and ice after storms. Failure to do so can result in fines or other penalties.

Minimizing Insurance Costs

Minimizing slip and fall accidents can translate directly into cost savings for building owners. Operations that are meticulous about snow and ice control programs, and document their efforts, may be rewarded with lower liability insurance premiums.[1]

Maintaining a Quality Reputation

Efficient, effective and responsible winter maintenance is a hallmark of quality management. In fiercely competitive commercial leasing markets, it can help property owners and managers maintain satisfaction among current tenants while fostering the positive image necessary to attract new ones. It can also enhance reputations among visitors who can tell that owners and managers – and by extension, building tenants – care about their safety and take pride in a well-maintained facility.

Best Practices for Snow and Ice Control

Effective snow and ice control means a lot more than simply having snow removal equipment and deicer on hand with vague instructions for their use in the event of a winter storm. Every facility should have a well-documented plan for managing snow and ice, and have staff ready to implement it for preventative action when a storm is forecast, or for speedy removal of ice and snow once foul weather arrives.

Know Your Facility's Characteristics and Needs

Begin by understanding needs at your facility and predict how key locations will be impacted by snow and ice events. Where is pedestrian traffic heaviest? Where do vehicles move, pause or park? What routes do people follow when moving between locations? Where is access for the disabled most critical? Are certain locations more prone to trouble due to exposure to weather, melt runoff, or vehicle traffic? Do sloped surfaces such as wheelchair or automobile ramps pose an elevated risk to pedestrians or motorists? Are there visibility issues related to poor lighting or blowing snow? It is also important to assess the

total surface area of pavement you will have to maintain and what equipment, materials and manpower will be required to respond to winter storm events and maintain safe conditions between storms.

Plan for All Conditions

Be ready for anything. Although mid-latitude or southern facilities may typically experience only occasional light snow, ice control programs should prepare for the uncommon events that cause the most trouble. For example, Dallas is well-known for its warm climate, but a few times a year it receives freezing rain that can bring the city and facilities to a halt. Further north, cities like Chicago and Minneapolis experience winter storms and very cold temperatures all winter long. Businesses and individuals in any region expect that sidewalks, steps, entryways and parking lots – as well as roads and highways – will remain open during bad weather and will be quickly returned to ice- and snow-free condition after a storm.

Make Mechanical Removal a Priority

The most economical and lowest impact method of snow and ice control is mechanical removal of accumulations during and after winter storm events. Prompt removal of snow and ice from walkways and parking lots minimizes compaction by foot and vehicle traffic. Mechanically removing any existing snow, before applying ice melter, enables the deicer to more quickly penetrate and break the bond between remaining ice and the underlying pavement. This can reduce the amount of deicer required and the potential for impact on infrastructure and the environment.

Use Anti-icing Treatments to Prevent Slippery Conditions

When foul winter weather is in the forecast, ice melter materials can be applied in advance as anti-icing treatments to keep subsequent freezing rain or light snowfall from bonding to pavement. This may eliminate the need to mechanically remove light accumulations and can make removal of heavy snow and ice faster and easier.

Speed and Reliability are Critical

Timely and reliable attention to snow and ice melting and removal are essential to allow tenants, visitors and customers safe passage. Winter maintenance plans should be designed to provide clear and safe conditions for the first vehicle and pedestrian traffic to arrive during and after a storm. Preventive maintenance should be performed to ensure equipment is well-maintained and available for duty on short notice. Adequate supplies of ice melting material should be stocked on-site for immediate access. Maintenance crews should be trained and ready to remove snow and ice quickly and properly. Standards for crew response and performance of winter maintenance activities should include adequate time for deicer to penetrate ice and loosen it for mechanical removal. This will help eliminate the tendency to over apply ice melter in an attempt to achieve faster results. Over application is a wasteful practice that may cause large amounts of residual deicer to remain on the surface long after snow and ice have melted, increasing the potential for indoor tracking and environmental impact.

Choose the Right Ice Melter

Several performance characteristics should guide the selection of an ice melter, but two are particularly important:

- **Reliable Performance** – Will the deicer perform well in the coldest temperatures your property may experience?
- **Ice Melting Speed** – How quickly will the material melt ice to minimize pedestrian exposure to potentially dangerous conditions?

The goal of any ice melting program is to minimize slip and fall hazards using the least amount of materials. When used excessively, all ice melting materials can have an impact on the natural environment, lawns and shrubbery, metal architectural features and interior flooring. Excessive application also increases costs. By using a faster deicer that performs well at low temperatures, there is less tendency to over apply.

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Comparing Ice Melters

To evaluate the performance reliability and the speed of melting associated with different ice melting materials, it helps to understand that solid deicers must first dissolve before ice melting can begin. The resulting deicer solution melts surrounding ice on contact.

Even though it may not be visible, water is always present on the surface of ice. The amount of water increases as temperatures rise and is reduced when temperatures drop. During colder conditions, when there is little water on the surface of ice, rock salt and some other solid deicers take longer to dissolve, resulting in slow melting action. However, hygroscopic deicers dissolve and begin melting ice very quickly even under cold, "dry" conditions. Hygroscopic deicers will attract any available moisture from the surface of the ice as well as the surrounding air so the ice melter can begin to dissolve.

Some deicers actually accelerate melting by chemically reacting with moisture to release significant heat. Ice melters that release heat are called "exothermic" and melt ice more quickly and at very cold temperatures. Other deicers are "endothermic". Rather than releasing heat, they must draw heat from their

surroundings to dissolve. Endothermic deicers work slower than exothermic products, especially when temperatures are cold and when little surface moisture is present to help them dissolve.

A variety of deicer products are available for maintaining safe sidewalks, steps, entryways, parking lots and driveways. Following is a brief overview of the most widely-used deicing materials and their performance characteristics.

Sodium Chloride (Rock Salt)

Rock salt, or NaCl, is a readily available and relatively inexpensive product that is widely used in its pure form or in blends with other deicers. With a lowest effective temperature of +20°F (-7°C), rock salt is a relatively slow and ineffective ice melter when temperatures are 20°F or lower. Rock salt is endothermic, which means it must draw heat from its surroundings to form ice-melting brine. Rock salt is moderately corrosive to unprotected metals. Lawns and other plants can be harmed if rock salt is over-applied or large quantities are directly applied to grass or vegetation.

Calcium Chloride

Calcium chloride is the most widely used non-sodium chloride deicer. Its lowest effective temperature, -25°F (-32°C), is below that of other common deicers, providing reliable performance at the widest range of temperatures. Calcium chloride is a hygroscopic material that attracts moisture from its surroundings, which speeds the creation of brine and gives melting action a fast start. Calcium chloride is also exothermic. As it dissolves in contact with moisture, it releases a significant amount of heat. This speeds the melting action, particularly at lower temperatures, and makes it more effective at colder temperatures than other products. Calcium chloride is often blended with sodium chloride to make rock salt a more effective ice melting option at colder temperatures. However, caution should be used in choosing a rock salt blend – many contain such a small percentage of calcium chloride that cold weather effectiveness is not significantly improved. Like all chloride-based materials – including rock salt (sodium chloride) and magnesium chloride – calcium chloride is moderately corrosive to unprotected metals, and can harm lawns and other plants if deicer is over-applied or large quantities are directly applied to grass or other vegetation.

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Magnesium Chloride

Similar to calcium chloride, magnesium chloride ($MgCl_2$) is a hygroscopic material, able to attract moisture from the air. However, unlike calcium chloride, solid magnesium chloride is a hexahydrate salt, meaning it is 53% water by weight. Because this solid product is so diluted, more of it must be applied to deliver ice melting capacity equal to calcium chloride or sodium chloride. Magnesium chloride's capacity to melt ice is somewhat less effective than sodium chloride (rock salt) after 20 minutes at 20°F, even though it is typically more expensive than rock salt. Magnesium chloride is exothermic but does not release as much heat as calcium chloride. It has a lowest effective temperature of 0°F (-18°C). Like other chloride-based ice melters, magnesium chloride has moderate potential for corrosion. Lawns and other plants can be harmed if magnesium chloride is over-applied or large quantities are directly applied to grass or vegetation.

Potassium Chloride

Endothermic properties and a lowest effective use temperature of +25°F (4°C) limits the use of potassium chloride for ice melting. The material performs more slowly than calcium chloride, rock salt and magnesium chloride with relatively low melt volume capability. Like other chloride materials, potassium chloride has moderate potential for corrosion and environmental impact.

Urea

Urea is also endothermic and has a relatively high lowest effective use temperature of +25°F (-4°C), which limits its use during typical winter conditions in northern regions and at higher altitudes. The material exhibits relatively slow ice penetration compared to other materials. Although urea is lower in toxicity to plants and wildlife than chloride-based products, its high organic content can elevate biological oxygen demand in rivers and lakes, which could pose a threat to aquatic life under certain conditions.

Calcium Magnesium Acetate

Calcium magnesium acetate (CMA) is an expensive material typically sold in blends with rock salt or other lower cost ice melters. Its lowest effective use temperature is about +20°F (-7°C), roughly equivalent to rock salt, and CMA exhibits slow ice penetration. The addition of CMA to chloride ice melters is sometimes claimed to reduce the potential for ice melter damage to steel and vegetation. However, the small amount of CMA typically incorporated in blended products is not sufficient to reduce corrosion to metal or reduce damage to plants. Like urea, CMA is lower in toxicity to plants and wildlife than chloride-based products, but the material's high organic content can elevate biological oxygen demand in rivers and lakes, creating a potential threat to aquatic life.

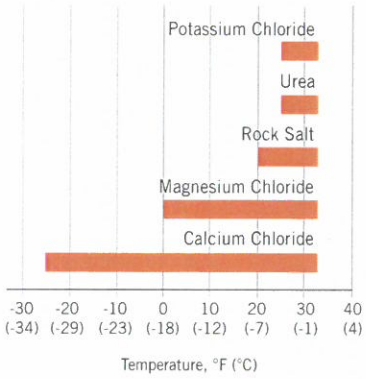
The Advantages of Calcium Chloride

Calcium chloride offers distinct performance advantages over other deicers, melting ice faster and at lower temperatures. The following charts compare the performance of calcium chloride to alternative products.

Melts Ice at Lower Temperatures

A primary advantage of calcium chloride is its reliable performance with its low effective temperature of -25°F (-32°C). It continues to attract moisture, generate heat and melt ice quickly under the cold conditions that slow the ice melting performance of other deicers.

Melting Range Comparison



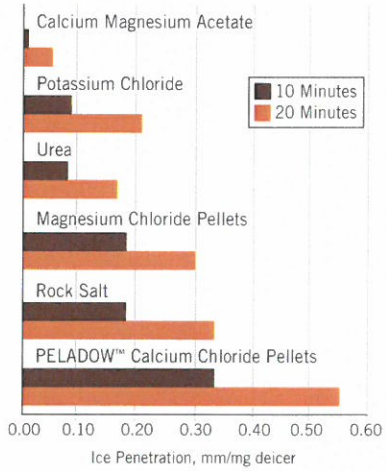
Melts Ice Faster

Fast ice melting performance can mean the difference between a dangerous slip hazard and sound footing when the first pedestrian arrives during or after a winter storm. Calcium chloride melts ice faster than other deicers for two reasons:

- It attracts moisture from its surroundings to form ice-melting brine faster than other deicers.
- It actually generates heat as it attracts and chemically reacts with surrounding moisture. For example, a pound of calcium chloride pellets will raise the temperature of a gallon of water by over 30°F (17°C).

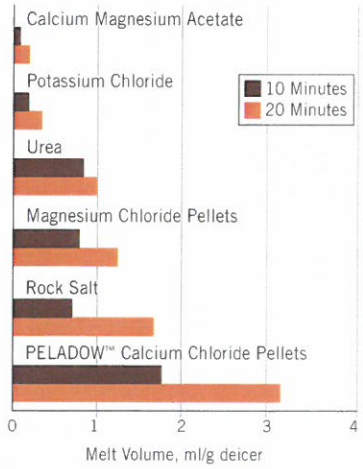
PELADOW™ Calcium Chloride Pellets from OxyChem have an additional feature that speeds ice melting performance. Their compact, round shape concentrates melting action on a very small area of ice surface, causing the deicer to bore through ice up to three times faster than other pelletized ice melters. This enables the calcium chloride to more quickly penetrate and break the ice's bond with underlying pavement. Once the bond is broken, mechanical removal operations can be performed more efficiently and effectively.

Speed of Penetration at 20°F (-7°C)



A melt volume comparison of PELADOW™ Calcium Chloride Pellets with other products at 5°F (-15°C) illustrates the greater effectiveness of calcium chloride when melting ice at low temperatures. PELADOW™ melts ice up to three times faster than competing materials.

Melt Volume Capability at 20°F (-7°C)



Proper Application of Calcium Chloride

As discussed earlier, the most effective, responsible and economical snow and ice control programs rely on mechanical removal first to enable application of the smallest amount of deicer needed to penetrate ice and disrupt its bond to pavement. This is true regardless of which deicer product is used. The performance advantages of calcium chloride can make it easier to reduce the amount of deicer used, but proper application procedures are required to achieve that goal.

Calibrate All Deicer Application Equipment

Calibration of application equipment is important for cost-effective product use and to minimize introduction of ice melter into the environment. This is especially important where large quantities of deicers are applied from vehicles across broad surface areas. Even handheld spreaders should be calibrated to control actual application rates. The McHenry County (Illinois) Snow & Ice Handbook for Sidewalks and Parking Lots[2] provides a useful example calibration procedure for smaller scale commercial operations.

Clear Accumulations Before Deicer Application

There is no reason to use excessive deicer to melt ice and snow that isn't bonded to pavement; it's not environmentally-friendly, it takes extra time, and it increases deicer costs. For best results, plow or shovel snow accumulations prior to spreading ice melter.

Application Rate

For smaller areas like sidewalks and building entrances, solid calcium chloride should be distributed evenly, preferably with a spreader. Follow the application instructions on product packaging to avoid over-applying deicer. Give the deicer time to loosen the bond between ice and pavement, then remove the resulting slushy ice mechanically.

Calcium chloride should be applied shortly after snow begins, to facilitate easy mechanical removal and prevent ice buildup. Removal of thick ice may require higher application rates to penetrate and undercut the ice layer.

Disperse Product Properly

Use of a handheld, mechanical dispersing spreader is typically a far better choice than using a simple scoop, especially for smaller areas like entryways and steps. Spreaders provide more even distribution patterns, help avoid formation of deicer piles that can lead to tracking mess, and help make sure the proper amount of deicer is used – potentially reducing waste by as much as 50% and limiting introduction of deicer into the environment.

Anti-Icing Applications Can Further Reduce Ice Melter Use

According to the Winter Parking Lot and Sidewalk Maintenance Manual[3] widely used in Minnesota, "Anti-icing is the most cost-effective and environmentally safe practice in winter maintenance." The manual states that anti-icing treatments applied in advance of foul weather often require only a quarter of the ice control material and cost just one-tenth as much as deicing operations implemented after a storm. Liquid and solid calcium chloride can be used for anti-icing.

A wide variety of portable, walk behind, and truck- or trailer-mounted equipment can be used for liquid applications while the same equipment used for applying solid calcium chloride for deicing can also be used for anti-icing treatments with solid products.

It is important to recognize limitations associated with anti-icing applications. First, anti-icing should not be attempted if rain or freezing rain is predicted because the treatment may wash away. Also, over-application of liquid anti-icers can result in slippery conditions. Finally, in storm events with heavier snowfall and dropping temperatures, anti-icing may not be effective in preventing ice and snow from bonding to the surface.

Managing Deicer Tracking on Interior Floors

When tracked onto hard surface flooring, slush, snowmelt and residual deicer can create a slip hazard. To manage tracking, follow the directions on the product label for proper deicer use. Deicer should not be over-applied, especially near entryways. Entrance mats should be used to avoid tracking onto interior floors. When tracking occurs, it should be cleaned from flooring as soon as possible. Because calcium chloride is highly water-soluble, it can be cleaned from hard surfaces with warm, fresh water.

Proper procedures for cleaning deicer from carpets include a multi-step process that removes both the deicer and any dirt that has also been tracked in and deposited on the carpet. The majority of experts recommend a cleaning procedure that includes a pH-neutral detergent wash followed by hot water extraction.

Effective Ice Control Addresses All Business Needs

Advances in snow and ice control practices have made it easier for building owners, facility managers and maintenance contractors to minimize the hazards of ice and snow and maintain access for pedestrians and motorists. By using the right deicing products and following best practices for their application, business needs for cost savings and reduced impact on infrastructure and the environment can also be met. Together, that's a robust prescription to meet the challenges presented by the forces of nature and a demanding business climate.

To learn more about best practices for sidewalk ice melting and the role of calcium chloride in implementing more effective, efficient and responsible ice control programs, visit **IceFreeSidewalks.com.**

About the Author

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[1] Martin Tirado, executive director of the Snow and Ice Management Association, consumerinsuranceguide.com

[2] Snow & Ice Control Handbook for Sidewalks and Parking Lots, McHenry County, IL, 2010.

[3] Winter Parking Lot and Sidewalk Maintenance Manual, C. Dindorf and C. Fortin, Minnesota Pollution Control Agency and Mississippi Watershed Management Organization, 2010.

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