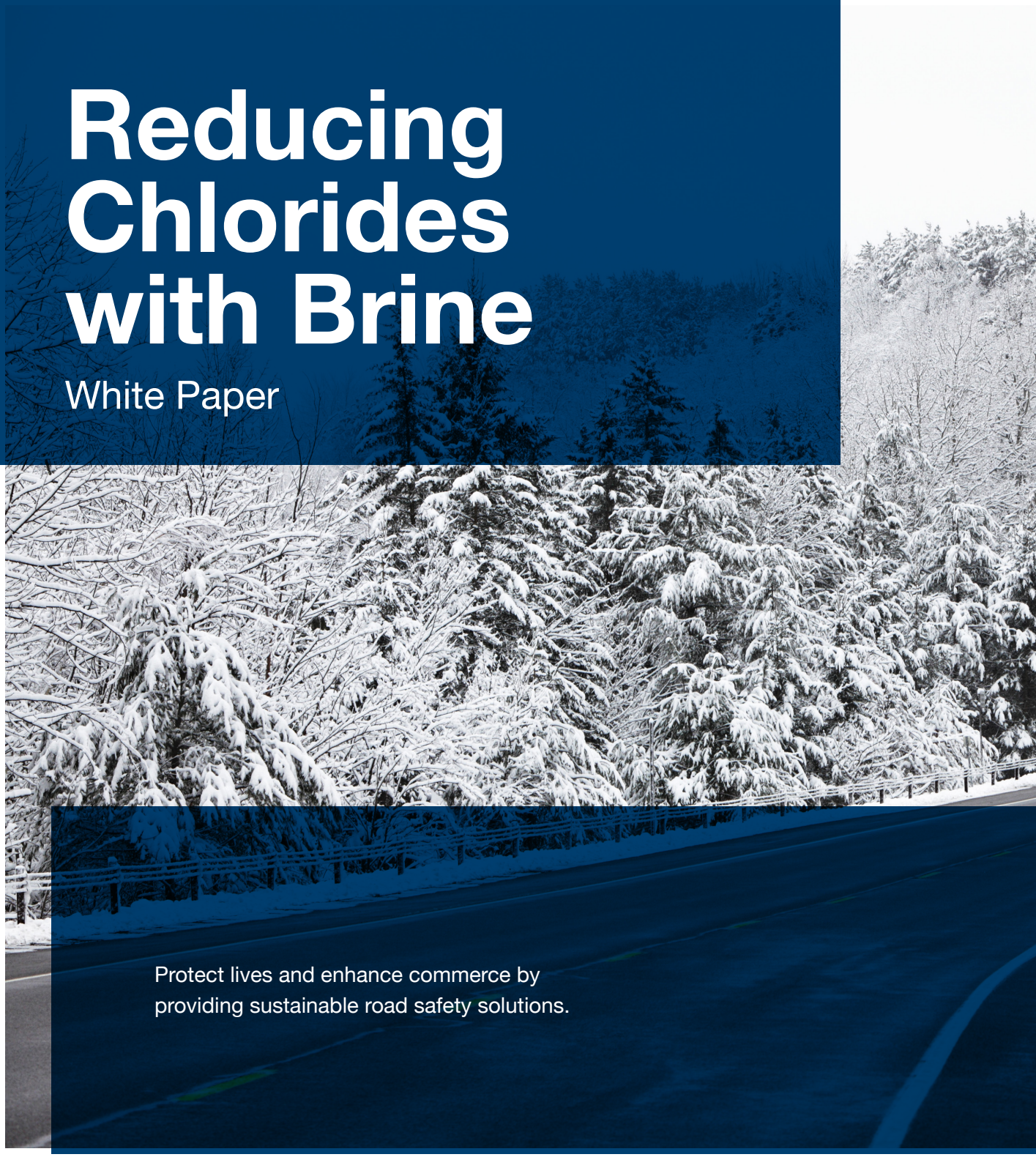
Cargill®

Reducing Chlorides with Brine

White Paper



Protect lives and enhance commerce by providing sustainable road safety solutions.

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Our Company

Cargill Salt, Road Safety

We are more than just a road salt supplier. Our innovative deicing and anti-icing solutions help protect the public from slicked roadways and walking surfaces as the snow and snow plows start to emerge for the season. From traditional deicing salt to treated salt, liquids and brine makers, even anti-icing pavement solutions - we have the ice melt products you need to help achieve your business goals when winter brings its heaviest snows.

We strive to be a winter road maintenance solution supplier that our customers depend on to deliver cost effective, environmentally conscious, high performing deicing and anti-icing products. We understand the importance of keeping winter roads safe and how it cannot come at the expense of the environment. Cargill provides customers with ice melt, deicing and anti-icing solutions that save lives, enhance commerce and reduce environmental impact.

Why is Road Brine the Best Solution?

While several alternatives to rock salt are being explored, one commercially viable option is using salt brine. Salt brine, which is made by mixing salt with water to create a liquid deicer, is already widely used.[1] Typically, brine is made of approximately 80 percent water and 23 percent salt.[2]

For effectiveness, a carefully timed application of brine should be sprayed on roadways before a forecasted winter weather system arrives. [3]-[4] Applying brine to roadways prevents snow from sticking, aids plowing, and allows the road to become dry quicker. Pre-wetting rock salt with brine accelerates the deicing process compared to dry road salt and helps prevent bounce and scatter of salt from the road, permitting lower salt application rates. Additionally, treatment of the pavement with brine helps prevent black ice from forming on the roadways.[5]

It is important to understand that salt does not actively deice unless it goes to a liquid or a brine state.[6] Applying road salt after the snow has fallen, essentially trying to fix the problem top-down, takes more time and salt along with leaving lower layers of snow stuck to the pavement. Pre-treatment of the road before a winter storm (called “anti-icing”) allows public works to melt snow bottom-up.[7]

Because it permits lower overall salt application rates, the use of brines is also more cost effective than using dry road salt alone.[8] Some towns have projected that anti-icing with brine before a winter weather system can save 30 to 40 percent of their materials budget.[9] Additionally, the initial investment can be lower, particularly for smaller municipalities that may only need a single brine-mixing tank and sprayer truck.[10]

Several municipalities have their own brine formulations that can be adjusted for local weather as well, making brine use an effective solution that can be “tuned” to specific needs.[11] For example, often these targeted formulations include calcium chloride or magnesium chloride to improve performance at colder temperatures or a carbohydrate, such as beet juice, to extend the longevity of the anti-icing effect after application.

In regard to environmental advantages, researchers studying brine's usage have found that municipalities using brine had 45 percent less salt in their storm water runoff compared to towns that only applied road salt.[12] Since brine also uses significantly less sodium chloride to be effective in deicing and ejects less salt in the air , researchers also believe brine use would contribute less chloride to the reaction that results in the production of air pollutants.[13]

Overall, municipalities who use brines as part of their winter road maintenance strategy combined with close monitoring of weather forecasts, targeted application and technologically advanced plows can greatly reduce the amount of salt on roadways and, in turn, in waterways.[14]

Reducing Chlorides with the Use of Brine

Why are Chlorides a Concern in the Environment?

During the past 60 years, Americans' demands for clear wintertime roads have driven use of road salt (sodium chloride) from about 164,000 tons a year to more than 24 million tons, according to U.S. Geological Society survey data.[1] In turn, the society reports chloride levels have doubled in some waterways, and some bodies of water have abnormal amounts of salt year round.[2]

In addition to rock salt's use on roadways, the private sector, including businesses concerned with "slip and fall" lawsuits, is another large user of salt.[3] Many experts believe the private industry could be using more salt than the government, but this data is difficult to track.[4] Other large chloride contributors are fertilizers used by farms, salt from water treatment plants and household water softeners.[5]

Unlike organic materials, salt is a mineral that does not degrade in nature.[6] And because road salt is very water soluble it tends to flow with the water from melted snow, which can cause it to accumulate in waterways, including ground water sources such as wells.[7]

Many municipalities also treat their rock salt – or purchase salt that has been pre-treated - with liquid magnesium chloride.[8] The reason for this is rock salt's ice melting effectiveness drops rapidly as the temperature falls below 25 degrees Fahrenheit.[9] Pre-wetting rock salt, especially with magnesium chloride or calcium chloride, helps keep the rock salt working as the temperatures decrease.[10] Prewetting does not add more chlorides to the environment. On a weigh basis, the actual chloride content is slightly decreased by pre-wetting, but more to the point, pre-wetting permits reduced application rates, which reduces chlorides going to the environment.

Dry road salt also is lofted on roadways by trucks, and this application method is not perfectly effective because high-speed traffic blows the salt off the roadway. [11]

The common estimate for loss of dry salt from bounce off the road is close to 30% – based on several field studies.

The effects of higher levels of chlorides in bodies of water are plentiful. Road salt polluted waterways potentially can contaminate drinking water, including inner bodies of water and wells.[12] Concerning chloride pollution in bodies of water, freshwater streams should have low- to no-salt content.[13] In lakes, salt persists until it is flushed out, which can take years.[14]

New research also is being conducted on road salt's effect on air quality. Road salt sprayed into the air releases chloride-containing gases, which research has shown to react with nighttime gases, the sun and other atmospheric compounds to produce ozone and particulate matter, which are key pollutants regulated under the Clean Air Act.[15-16]

For habitats contaminated with road salt, chloride is unfavorable for fish, insects, animals, algae and plants.[17]

While some road salt makes its way into the greater environment, some road salt also remains on roads and bridges, causing corrosion and compromising their integrity.[18] That same type of corrosion can happen to lead lined pipes, fittings and fixtures carrying road salt contaminated drinking water.[19] This has been shown to cause contamination with lead along with higher levels of manganese, mercury and other heavy metals that are toxic to humans.[20-21]

Ultimately, the way road salt is being applied now is unsustainable for humans and the environment, and the industry will need to look for ways to improve application and usage.[22]

What are the Solutions for Reducing Chlorides and the Challenges Associated with Them?

Several road salt alternatives have entered the market purportedly as more environmentally friendly. For example, beet juice and beet juice additives are commonly known as an alternative to rock salt. As a spray-on additive, beet juice is often included to help stick salt to the road and thereby reduce salt application rates.

Other alternatives, such as using briny waste from beer brewing, fermentation and cheese making, also have been used in different regions. Mixing sugary molasses discards, grape extracts, and vodka byproducts among other byproducts of food processing have been explored in different regions as well.[1-2]

Food byproducts, and even beet juice, have not been shown to be as effective as road salt, and they can have environmental impacts of their own. For example, initial research on beet juice additives shows this organic compound can increase microbial respiration in water.[3] Depending on the time of day, increasing microbial respiration reduces the oxygen in water, and less oxygen in the water could have a negative impact on aquatic life.[4]

Additionally, many municipalities have found that food-byproduct rock salt alternatives can cost three times as much or more.[5-6]

Some towns also use traction sand mixed with chips from chip and seal projects.[7] These sand and chip mixtures often get swept up and reused, but can still be problematic with sand being washed into streams and lakes that could potentially form deltas.[8]

Another alternative to road salt is the liquid deicer often used on airport runways, potassium acetate.[9] Potassium acetate is biodegradable, doesn't corrode infrastructure and works in much colder temperatures than salt.[10] The challenge with potassium acetate is that it costs seven times more than road salt, and researchers haven't fully explored how its runoff could affect waterways.[11] Researchers speculate that a potential environmental impact of too much potassium acetate is causing too much bacteria to grow, which could eat the oxygen that freshwater plants and animals need.[12] Potassium acetate also could potentially save towns money, though, on road and bridge repairs because it doesn't cause the same levels of corrosion as road salt.[13]

Reduction Solutions

Currently, an exact replacement for road salt to keep roadways clean does not exist.[14] Nevertheless, decreasing the amount of road salt used is a necessity for the environment and feasible for many municipalities.[15]

To cut back on road salt, some states are even passing bills and proposing new rules.[16] Some cities are now required to teach businesses and institutions about salt use. In other cities, developers are now required to install runoff treatment systems whenever they replace more than an acre of pavement.[17] Builders and homeowners are likely to face new rules as well to keep rain and melting snow from polluting waterways.[18]

Most public works try to be responsible with their use of chlorides, which means not over applying road salt and not applying it where it doesn't need to be applied.[19] Road salt also can be minimized by plowing more often to prevent ice from forming along with applying salt at the right time and temperature.[20]

Some municipalities are going as high tech as possible. For example, some public works use "live edge" snowplows that conform to the shape of the road and can reduce the use of salt.[21] Many salt trucks now use GPS and track routing software to increase efficiency and calibration equipment to ensure proper salt distribution.[22-23] Sophisticated weather forecasting data also is being made available to road crews for targeted application of road salt.[24] Using technology to generate more localized weather forecasts helps towns anticipate needs so that trucks using a brine solution can pretreat roads and reduce salt use overall.[25]

Some states also are using air and pavement temperature sensors to assess conditions.[26] Experts also have learned to drive trucks slower to reduce road salt bouncing off the roadways.[27] Certified training programs are available to many road salt contractors as well.[28]

Additionally, public works can simply limit salt contamination by covering salt piles to protect it from the weather. Salt sheds can mitigate any potential environmental impacts associated with handling and storing of salts at the facility, such as dust emissions from the discharge of the conveyor belts and storm water brine.[29]

What are Cargill's Brine Maker Solutions?

Records show an uptick of conversation, especially from traditional news outlets, on the use of road-safe brine to reduce rock salt usage during winter months. Brine is chosen by many winter maintenance agencies due to its low-production costs and material savings coupled with its effectiveness. With the growing understanding of brine's usefulness, more options are available today than ever before. It is important to invest in the best solution to fit the job's needs.

In turn, Cargill has created a growing line of brine makers to help winter maintenance teams succeed in providing safe roads. Cargill's line of AccuBrine® solutions help municipalities achieve chloride reduction along with always ready, push-button ease. Cargill's AccuBrine solutions offer durability, continuous production, one-person operation, built-in redundancy, intuitive cleanout and fewer moving parts along with Cargill's continuous support.

Cargill's AccuBatch® and AccuBrine® NXT-Gen brine makers:

AccuBatch®

For users who need smaller batches of brine solution, Cargill offers a high-quality, entry-level brine making system, the AccuBatch® brine maker. AccuBatch® is the only brine maker on the market that features a conductivity sensor for automatic brine concentration measurement. Its simple plug and play design allows for easy setup, maintenance, operation and cleanout. Road crews can produce up to 2,400 gallons per hour with AccuBatch®.

AccuBrine® NXT-Gen

For users who need a continuous flow brine maker that can produce multiple blended products, Cargill developed the large, automated system brine maker AccuBrine® NXT-Gen. This next generation of brine production is both efficient and cost-effective. Users consistently achieve ideal brine concentrations and can continue to grow their liquids program with a modular add-on system that allows road crews to create customized blends with the additives of their choice. AccuBrine® NXT-Gen can produce up to 6,000 gallons per hour.

Cargill's AccuBrine® Blend and AccuBrine® Blend V2 Loading and Blending Systems

AccuBrine® Blend

For those who need to blend up to three additives and who have larger capacity tanks, the AccuBrine® blend truck loading and blending system is available. The stand-alone truck loading and blending system works independently of the brine maker to help winter road maintenance teams produce customized liquid blends to tackle any winter weather event. Its modular design enables users to build on their current liquids program and grow as their needs change. Its touch-screen HMI control panel allows it to work independently, and its high-volume pump fills trucks fast. AccuBrine also works with AccuBatch® and AccuBrine® NXT-Gen.

AccuBrine® Blend V2

For users who need a compact portable system that can accommodate two additives, Cargill offers the AccuBrine® Blend V2. The modular truck fill and blending system enables road maintenance teams to produce custom blends by mixing salt brine with up to two liquid additives to enhance the brine's performance. The AccuBrine® Blend V2 station works on any brine maker, not just Cargill brine makers. The V2 uses a stacked blending method to offer an accurate, customized blend and eliminates the need to send blended product to separate storage tanks as a custom blend can be made in real time as it is being sent directly to a liquid application truck. Additionally, V2 is an enclosed system with heater and doesn't need to be inside a building. The AccuBrine® Blend V2 also works with AccuBatch® and AccuBrine® NXT-Gen or the user's current brine maker.

Regardless of the amount of brine users need to make or the number of mixes users want to create, Cargill offers the brine maker system that will help winter road crews accomplish their safety and business goals and set them up to grow their program into the future.

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