

# ***How do Performance Enhancers and Corrosion Inhibitors Improve Traditional Chloride Deicers?***

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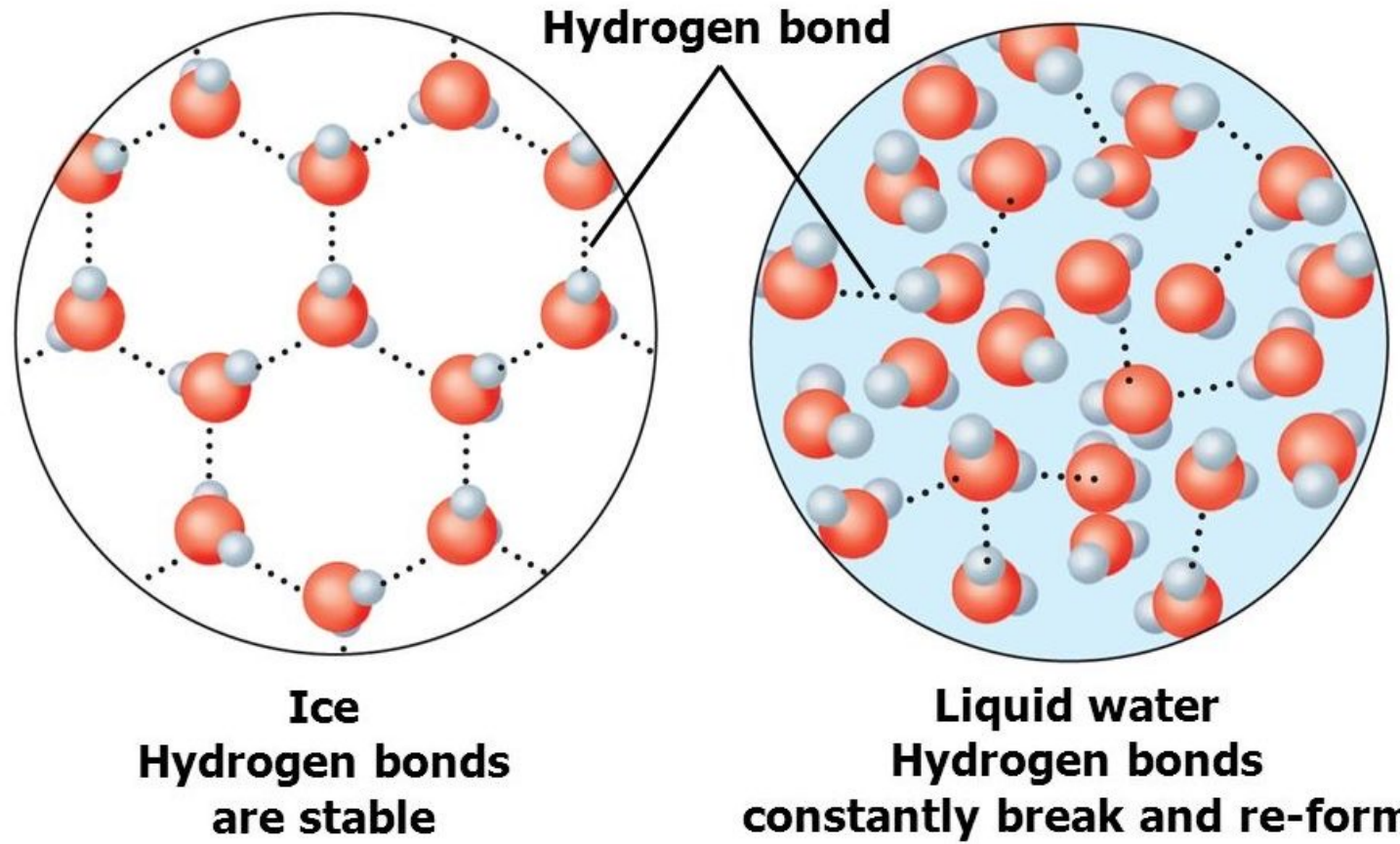
# History

- Liquid deicers, primarily Magnesium Chloride, is introduced in the 1990's
- DOT's were looking for higher performing deicers that would work at lower temperatures and improve overall highway safety.
- In 1996 CDOT first uses Magnesium Chloride on I-70 and has 46 less road closures than the previous winter season.
- The Pacific Northwest Snowfighters is created (PNS).
- The 1990's / early 2000's saw innovation and refinement of liquid deicers through the addition of carbohydrate based performance enhancers, corrosion inhibitors, as well as improved application equipment and technology.



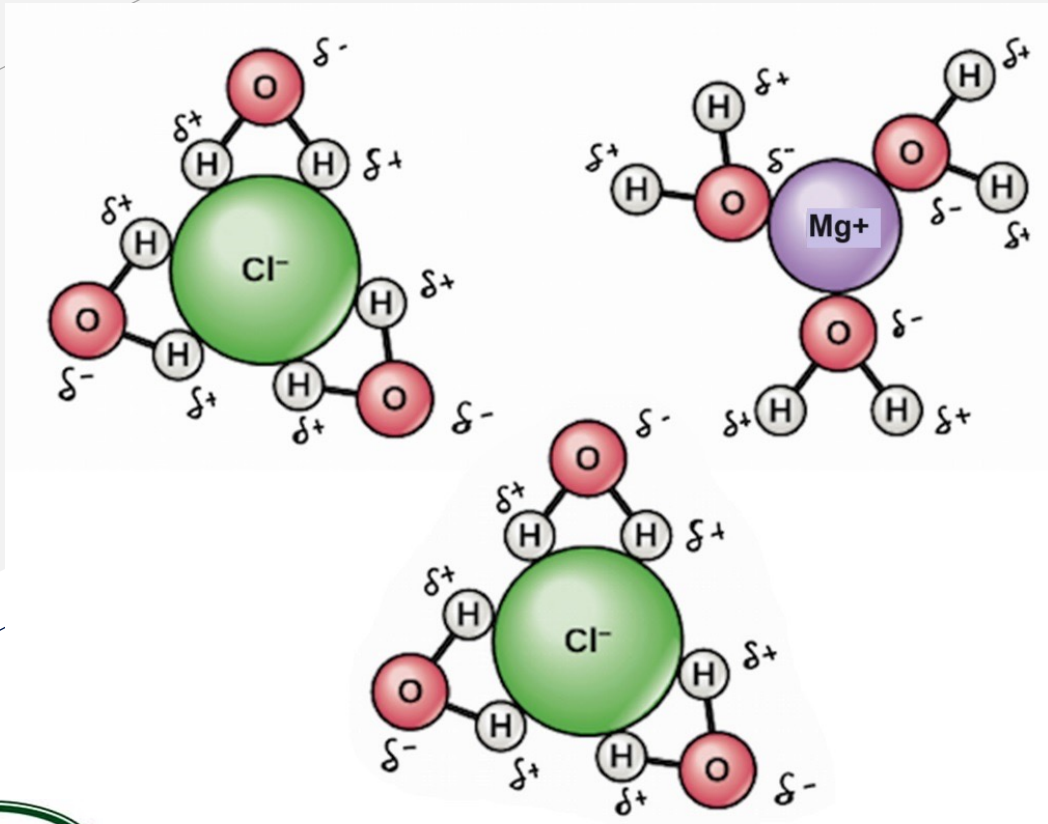
# The Basics: Opposites Attract

Ice Crystals are formed as temperatures drop and water molecules slow down. This allows for hydrogen bonds formed by the polarity of the water molecules to link and create a crystalline structure.



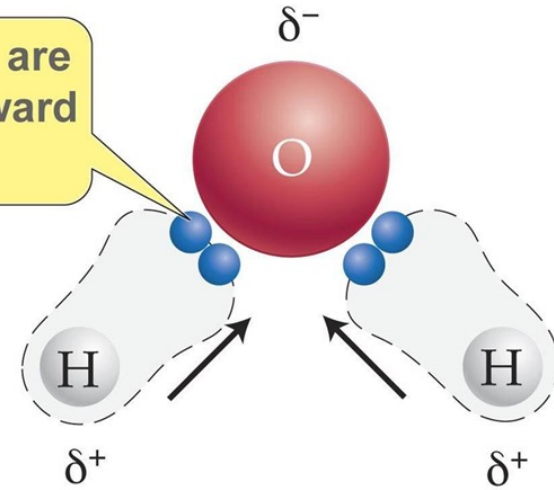
# Opposites Attract

Salt Molecules have a stronger attraction to the water molecules and can break apart the weaker hydrogen bonds causing the ice crystals and turn ice back into liquid water.



## Partial negative charge

Electrons are pulled toward oxygen.



## Partial positive charge

Sodium Chloride is the most common salt used for melting ice, but Magnesium Chloride is more efficient.

This is due to the Magnesium atoms having a stronger attraction than Sodium, and also have double the chloride atoms.

Magnesium Chloride is also more soluble in water than Sodium Chloride. This allows for higher solids content and lower working temperatures than traditional Sodium Chloride salt.

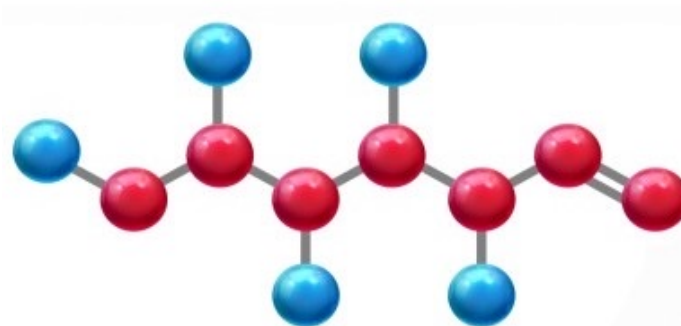
# Performance Enhancement



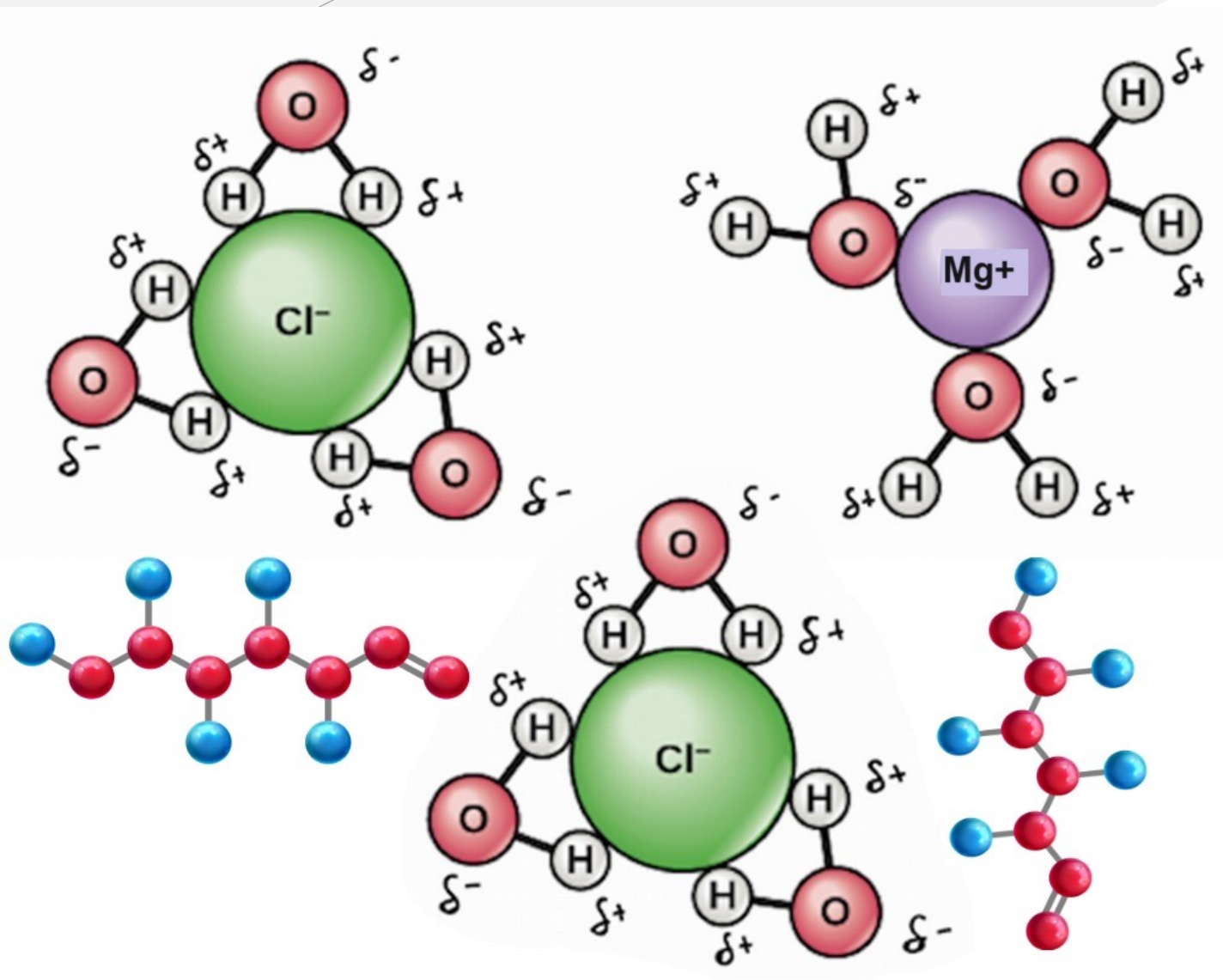
Carbohydrate (sugar) additives are added to the liquid chlorides to help lower melting points, improve working temperatures and extend working times.

These performance enhancing products also improve the viscosity allowing liquid deicers to be applied to rock salt piles.

Carbohydrates work by interfering with the re-crystallization of ice as the deicing product becomes diluted from the melting ice.



# Performance Enhancement

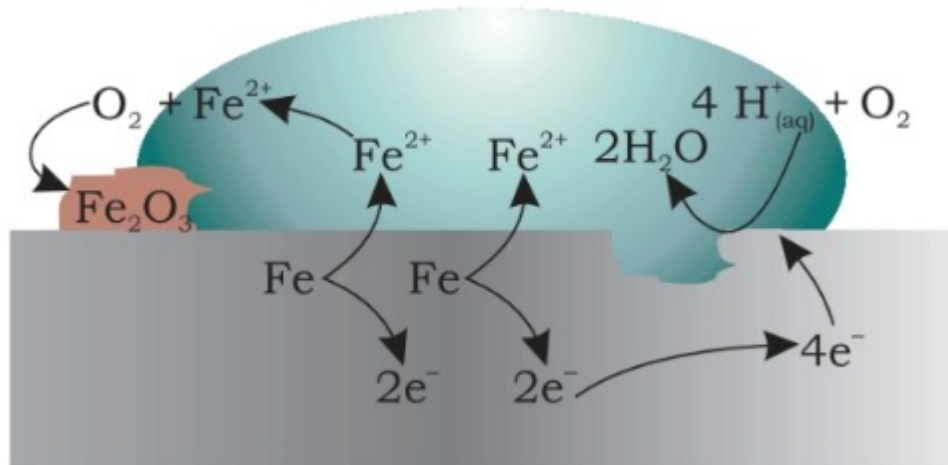


# Corrosion Inhibition

The corrosion of steel involves an electrolysis in which the metallic surface releases electrons into an electrolyte, such as a layer of water, in the presence of oxygen.

Passive corrosion inhibition uses corrosion inhibitors, that through formulation with deicing products, do not allow the movement of electrons to interact with the metal surface.

The electrons bond to the corrosion inhibitor before they have a chance to interact with the surface of concern.



# How Liquid Deicers Are Applied

The 3 most common uses for liquid deicers is Anti-icing, Deicing and Stockpile Treatment (including at the salt spinner)

These 3 practices allow highway departments to be pro-active instead of reactive to approaching inclement winter weather.

Rock salt, without the presence of a liquid deicer, can only be used effectively as a reactive deicer.





# Anti-icing



The practice of anti-icing changed the game for winter highway maintenance. No longer having to be reactive, highway crews could now treat before a storm. This allows for:

- Wider coverage of treated roads
- Prevention of ice bonding with the road to make plowing easier
- Reducing the overall amount deicer, fuel and labor needed per storm

*Studies show it costs 5 times more to break the bond than to prevent the bond*

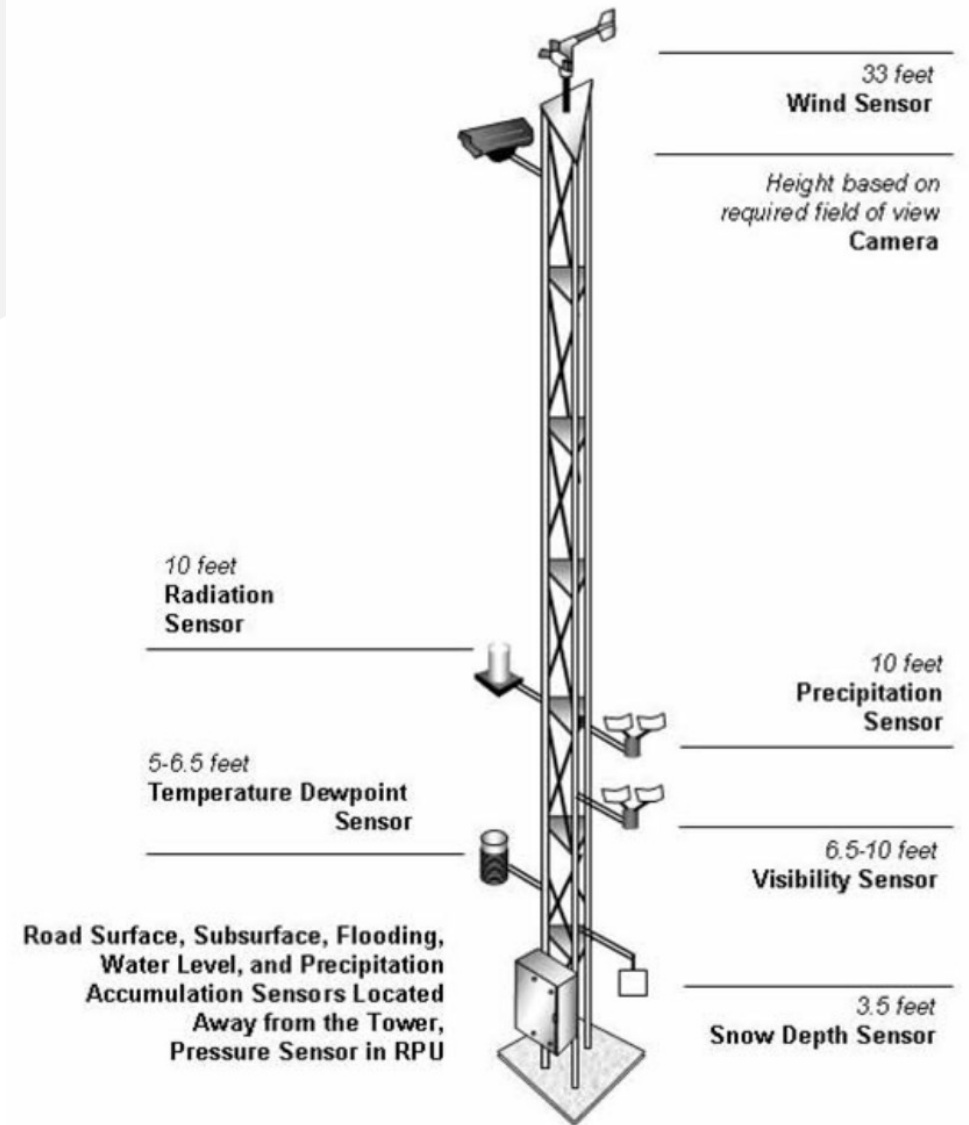
- Achieving “bare pavement” faster than with traditional rock salt
- Frost prevention

# Anti-icing

Anti-icing tools and practices have continued to improve as knowledge and experience have grown.

No longer a novel concept, anti-icing is an accepted practice across the US and Canada. There are many peer to peer sites and studies that take the guess work out of starting and maintaining a successful anti-icing program.

Technology has also continued to improve allowing for better “up to date” data to be at your disposal to make proper application decisions.



**VAISALA / Navigator** City of Fort Collins 11:52

Map Station Summary Station Wall Stations Forecast Alerts Reports **Mobile DSP** Tools Help

25/10/2017 17:47 English

Map Table Pr Management Map Key

Today History

February 2017

Mon	Tue	Wed	Thu	Fri	Sat	Sun
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	1	2	3	4	5
6	7	8	9	10	11	12

S.	Registration	Begin	End
<input type="checkbox"/>	Fort Collins DSP 1	19:36:17	14:56:56
<input type="checkbox"/>	Fort Collins DSP 1	14:20:05	14:56:56
<input type="checkbox"/>	Fort Collins DSP 1	14:14:20	14:15:41
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<input type="checkbox"/>	Fort Collins DSP 1	00:50:17	00:52:44
<input checked="" type="checkbox"/>	Fort Collins DSP 1	19:36:17	20:43:59

Temperature Grip Surface state Freezing risk Ice Water Frost / Snow



**VAISALA / DSP310** Patrol Car Driver 16:00

Measuring

**0.69**

Grip Surface State **Wet**

Water **0.03** in

Snow **0.00** in

Ice **0.00** in

Surface Temp **38.5** °F

Record



# Deicing

Liquids are effective as a deicer during a winter storm event. The benefits of using liquids during a storm include:

- Faster penetration to the pavement to remove ice bonded to the road surface
- Lower working temperatures than traditional rock salt
- Longer working times allowing for greater coverage
- Improved residual performance



# Salt Treatment

Liquids are also effective at improving the rate at which traditional rock salt works. Whether sprayed on the salt or pre-treated in a stockpile, Liquid deicers can enhance rock salt by:

- Speeding up the melting rate (Rock salt doesn't begin to work until it liquifies)
- Lowering the effective temperature of rock salt
- Adding corrosion inhibition to the rock salt
- Corrosion inhibition to the plow truck when used as a stockpile treatment
- Reducing the bounce and scatter to keep the salt on the pavement
- Reducing the amount of salt needed per storm allowing each truck to treat more roads per trip



# Not All Liquid Deicers Are Alike

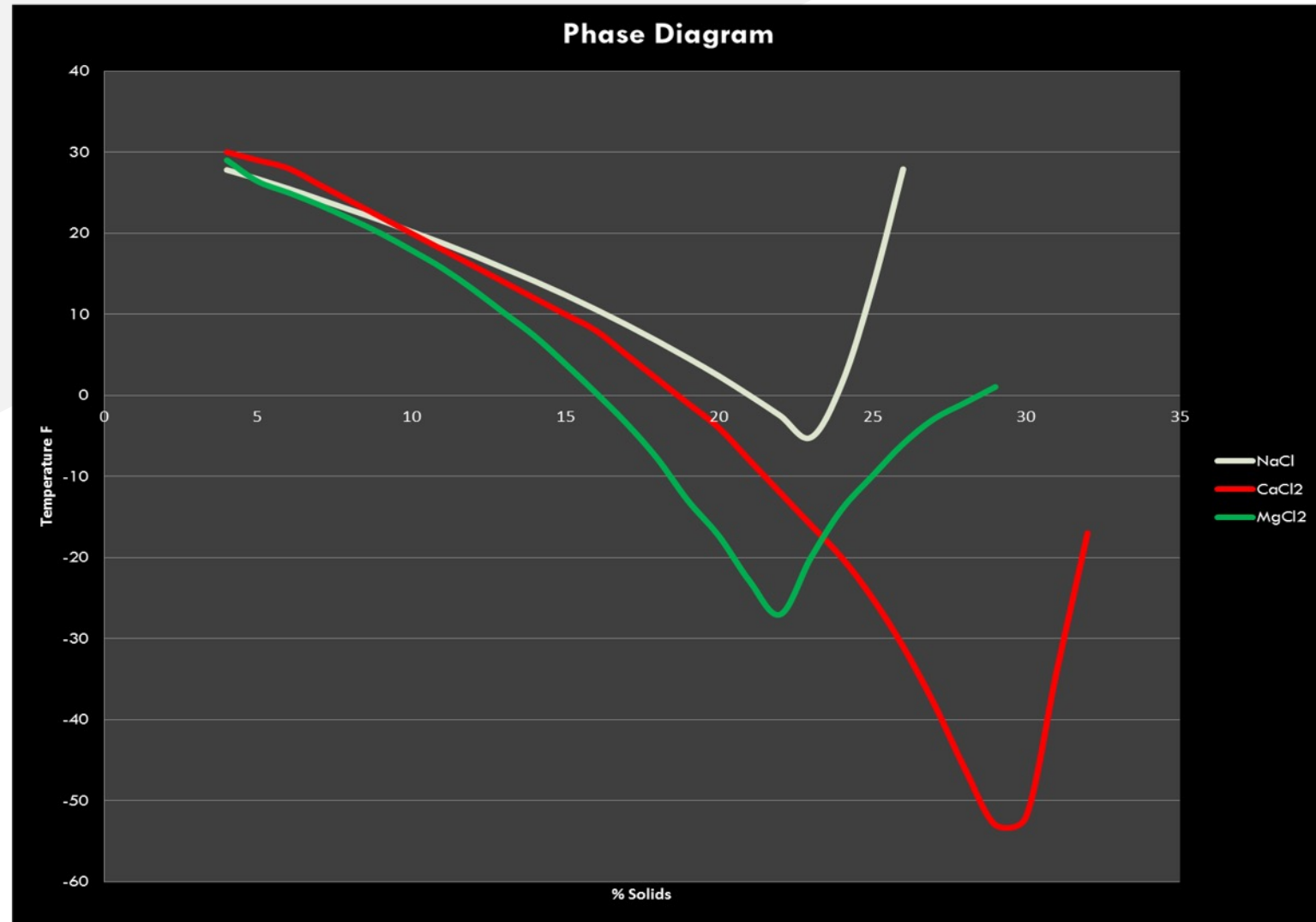
The 3 most common chlorides used for liquid deicers are:

- NaCl Brine (Salt Brine)
- Magnesium Chloride (Mag)
- Calcium Chloride (Calcium)

All 3 can be modified with performance enhancing additives and corrosion inhibitors.

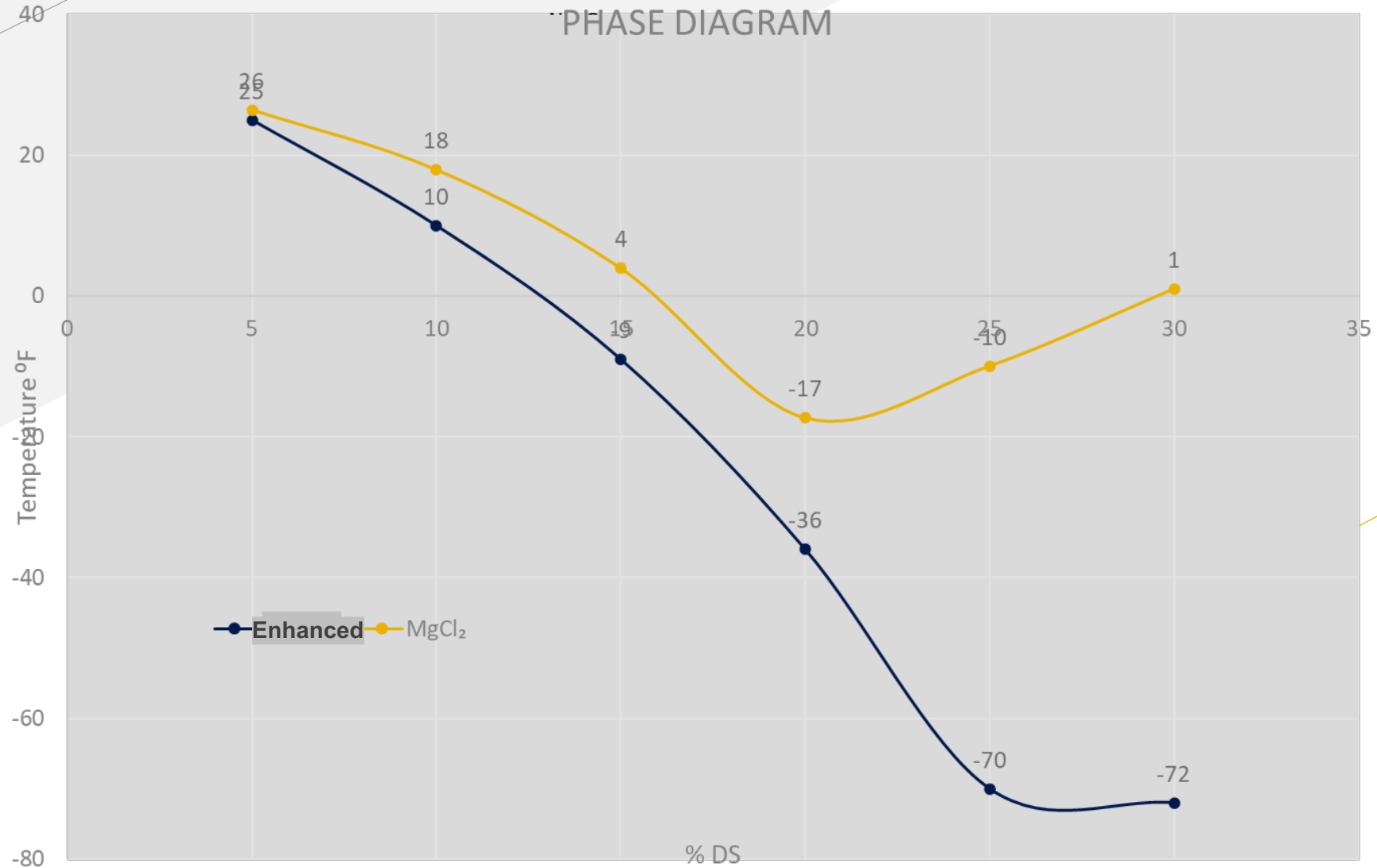
Magnesium Chloride is more effective at lower concentrations as it is diluted from melting snow and ice.

***“The dilution of solution!”***



# Enhanced Chlorides

An enhanced chloride can improve the melting power of a traditional chloride deicer by lowering the effective temperature and improving the melting capacity.



# Helping the Environment



Liquid deicers allow you reduce your overall chloride consumption while reaching bare pavement sooner.

This concept reduces the amount of rock salt in the environment that can damage trees and surrounding ecosystems.

Mag Chloride is used in agriculture applications as a fertilizer to improve the soil.

The additives used to improve the performance of the chloride are also biodegradable.





# Helping the Environment



Performance enhanced deicers reduce airborne particulates compared to traditional sodium chloride deicers.

This helps reduce damage to vegetation along the highway



# Reducing Costs

A strategic, well planned liquid deicing program will save you money in multiple ways:

- Pro-active instead of re-active
- Longer routes equates to less time with an empty truck
- Lower working temperatures saves time and money going over the same roads
- Reduced fuel and labor costs
- Corrosion inhibition extends the life of the equipment and infrastructure

Don't be fooled that cheaper is better. Cheaper products that underperform will cost more in the end!



# Reducing Costs

Higher performing liquid deicers also reduce the burden on storage. The more effective the product, the less you use.

There are many styles of pumps and nozzles to use on an anti-icing truck. Make sure you have the proper set up for the product you are using and it is properly calibrated.

Uncalibrated equipment can undermine your cost savings and create a safety issue when anti-icing.



# Education



For a liquid deicing program to thrive and achieve its goals, education is key.

If everyone doesn't understand the goal, or how the products work, the program will suffer.

Use all the resources available to you to keep up on trends, new practices and education.

# What Will the Future Bring?



**YOU DECIDE**  
**STRAIGHT AHEAD**

Covid 19 has put new pressure on the industry

- Staffing issues
- Product costs and availability
- Rising fuel costs

How do we adapt?

- Continue to use best practices
- Learn from the past to grow the future
- Educate the next generation
- Innovation