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Cargill

Afternoon Speaker August 2

Towards a Better Understanding of Pre-wetting – Insights from the Lab

SALT SYMPOSIUM

Towards a Better Understanding of Pre-Wetting – Insights from the Lab

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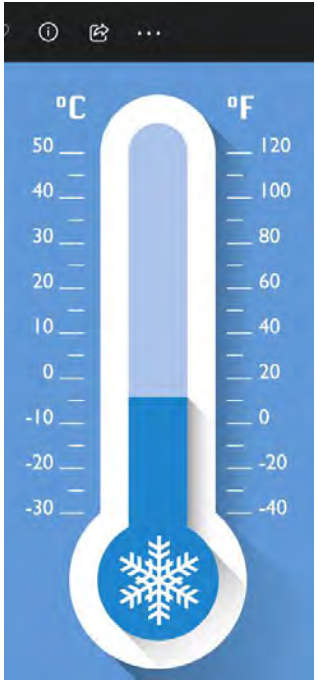
Cargill Road Safety

What are we talking about with “pre-wetted salt”?

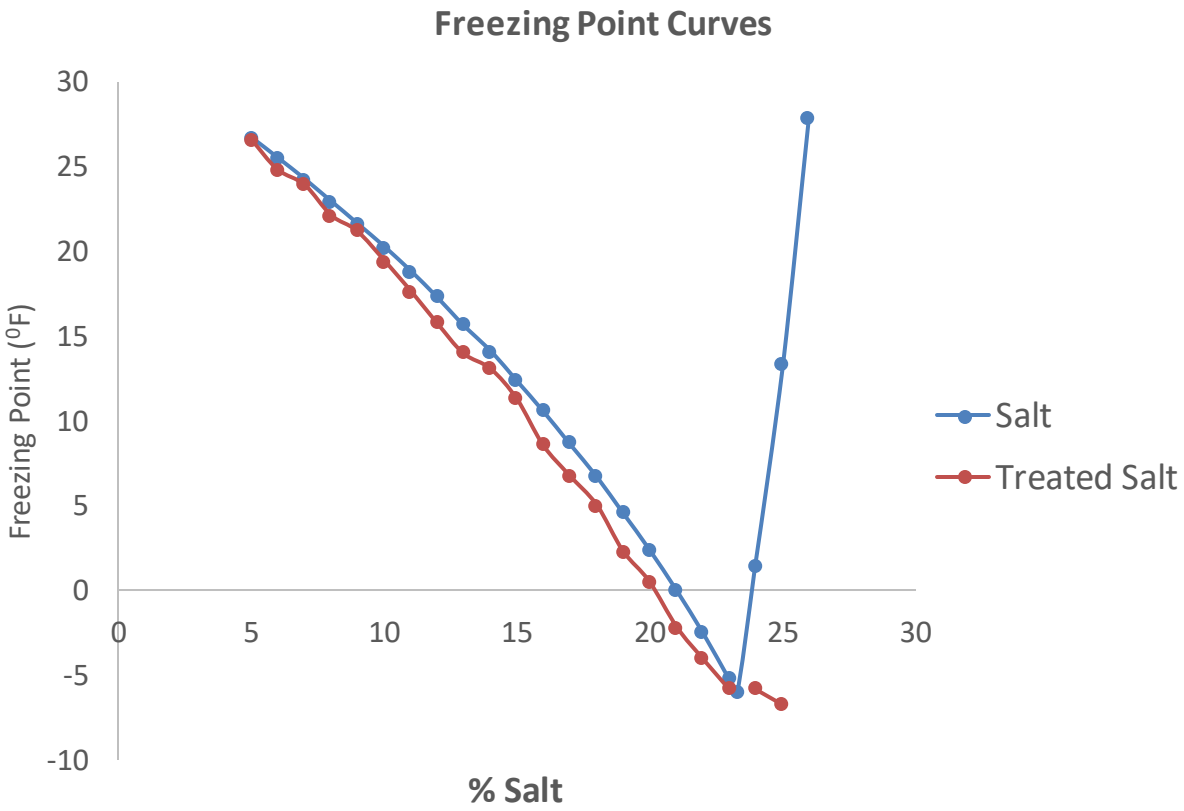
- Pre-treated salt
- Salt wetted at the spinner
- “Shake and Bake”
- Slurry

What does pre-wetting do for us?



Does it make salt melt more ice?

Does it lower salt's eutectic temperature?



The freezing point curves for salt and salt treated with MgCl2 + OBPE brine blend are essentially identical

Eutectic has not changed!

Why do we use pre-wetted salt?

Accelerate rock salt's ice melting ***speed***

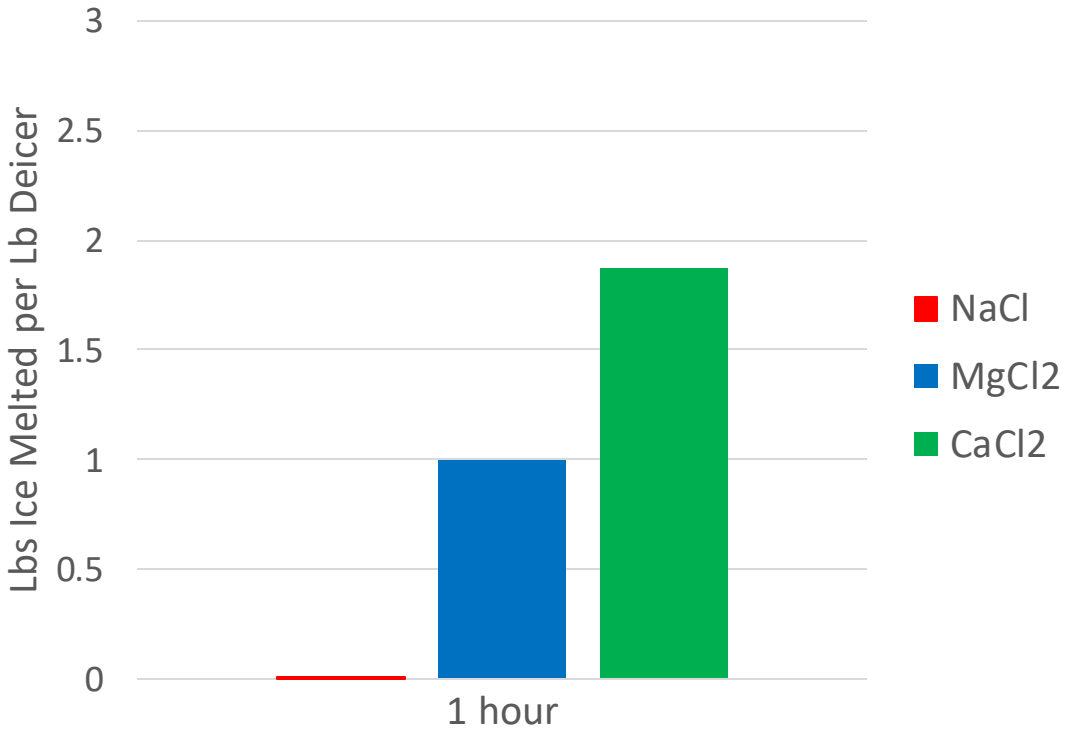
Reduce rock salt bounce/scatter

Reduce salt application rate!

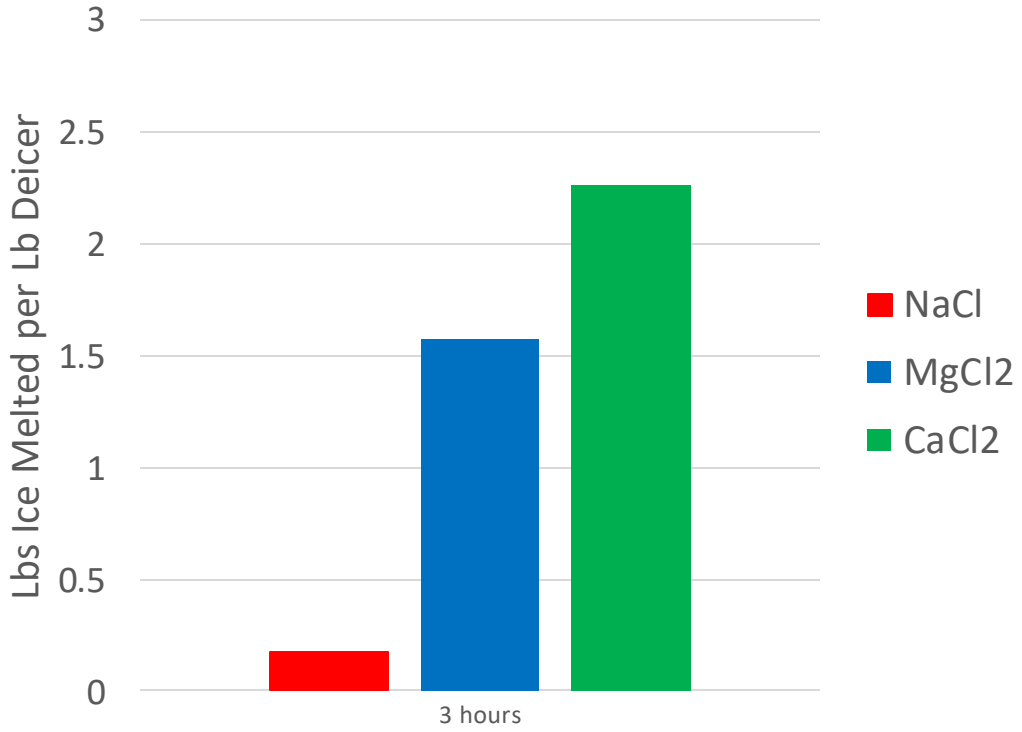
Why do we care about measuring ice melting speed?

We care because any ice melting capacity not used before the plow returns is wasted. And because it is all we can control!

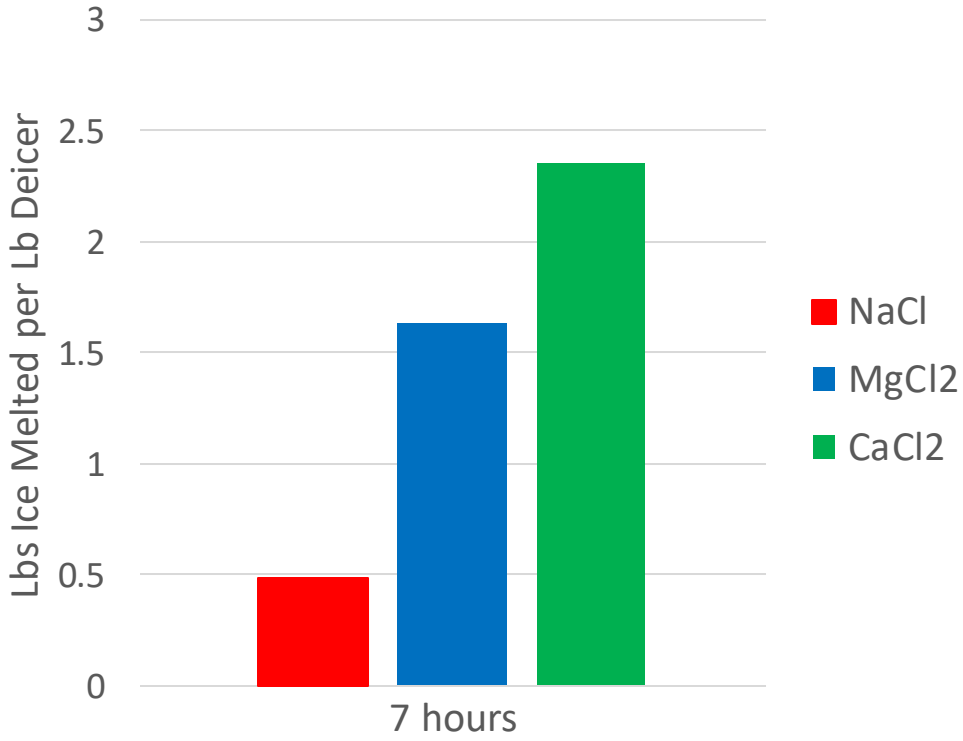
Ice Melt at -4 ^{0}F After 1 Hour



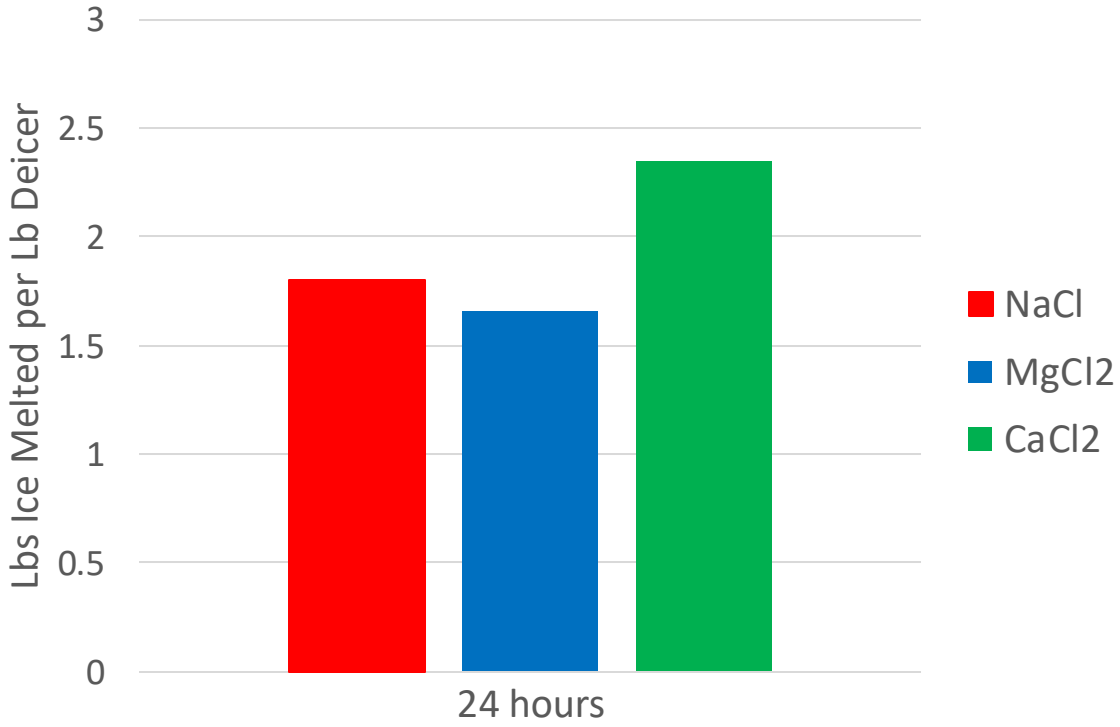
Ice Melt at -4 ^{0}F After 3 Hours



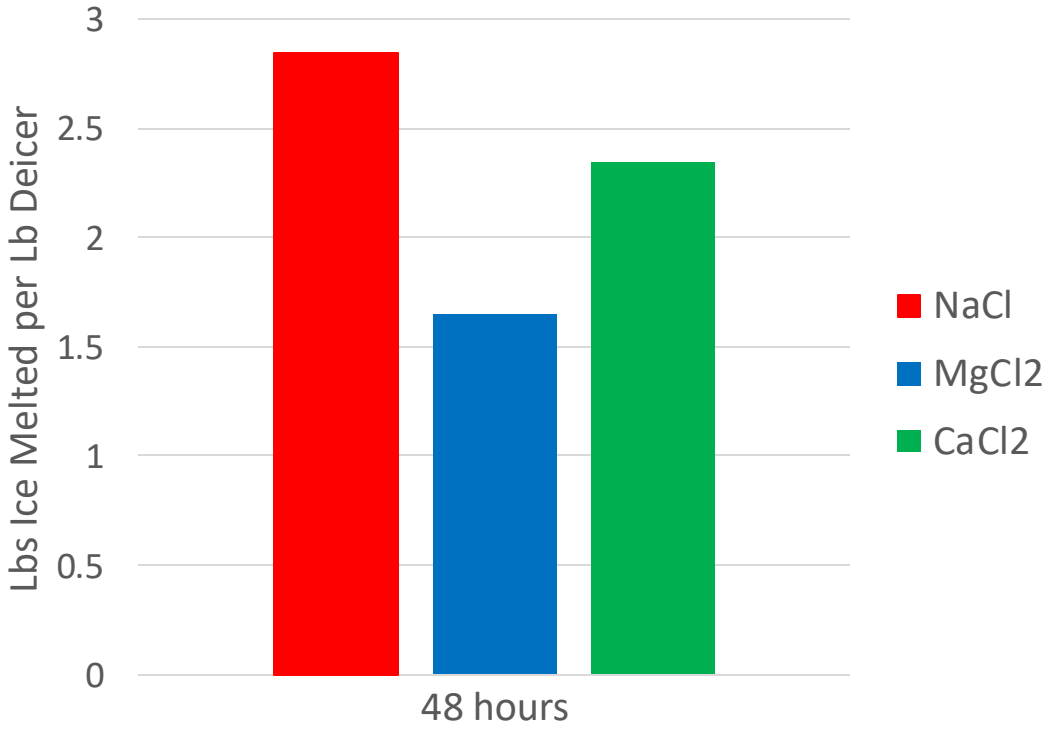
Ice Melt at -4 ^{0}F After 7 Hours



Ice Melt at -4 ^{0}F After 24 Hours



Ice Melt at -4 ^{0}F After 48 Hours



Ice Melting Performance

Faster Ice Melting **=** **Lower Working Temp**
Less Salt Waste
Faster recovery

Michigan Field Ice Melting Observations (1974-75)

Temperature	Pre-wet Salt*	Dry Salt
28 ^{0}F – 32 ^{0}F	Starts immediately	Minor delay
25 ^{0}F – 28 ^{0}F	Starts immediately	10-20 minutes delay
Below 20 ^{0}F	Minor delay	$\geq$ 30 minutes delay

*Prewet with liquid calcium chloride. H. Lemon, 1974-75 Prewetted Salt Report. Michigan Dept. of State Highways and Transportation, 1975

Deep Dive into How Pre-wetting Works

How does pre-wetting speed up the ice melting (what is the mechanism)?

Does the choice of pre-wetting liquid matter?

How much pre-wetting liquid do we need?

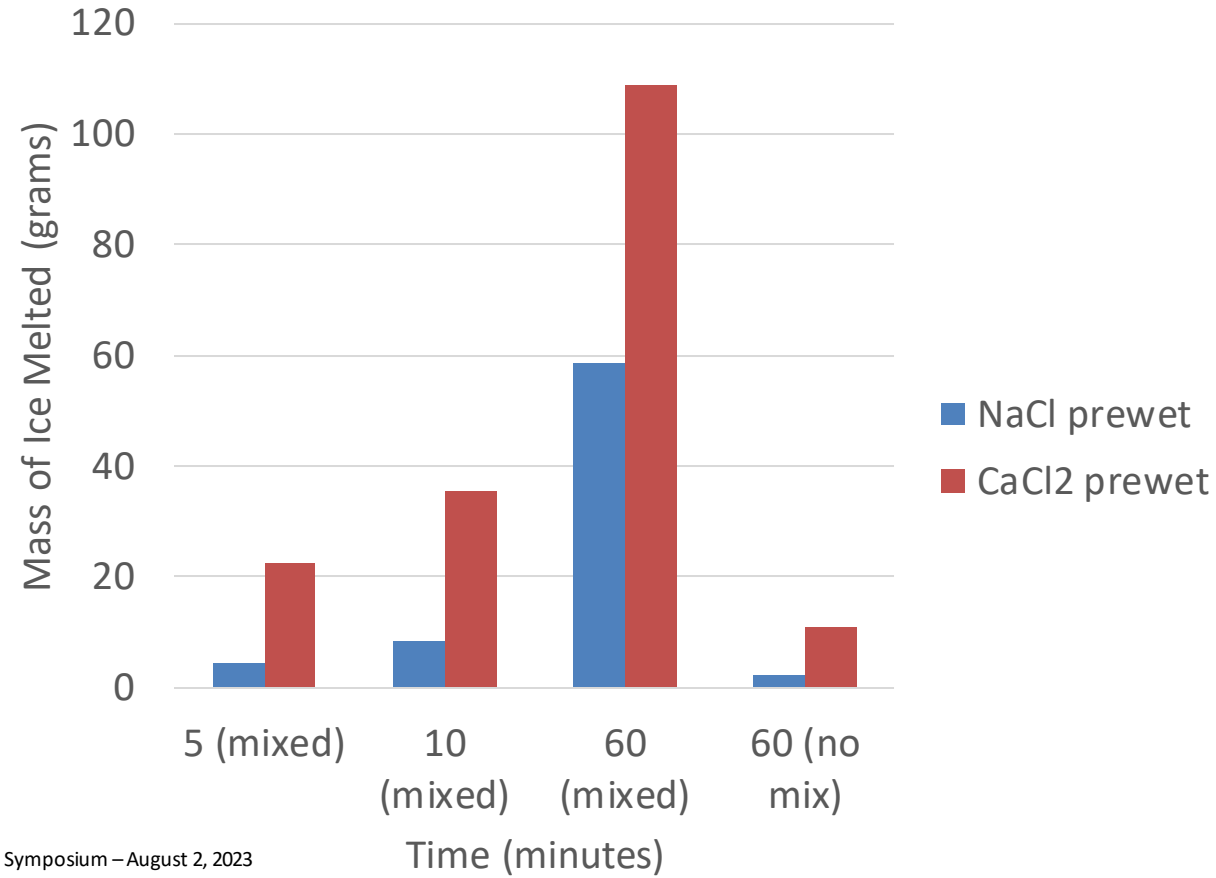
What effect does traffic action have?

Measuring the effect of different pre-wetting brines on the ice melting speed of salt

Need to subtract the melt contribution due to the liquid from the treated salt to see the effect of the liquid on the ***salt alone***

Approach – use “spent” pre-wetting brines so they have zero ice melting capacity of their own and we can isolate the effect of the brine chemical

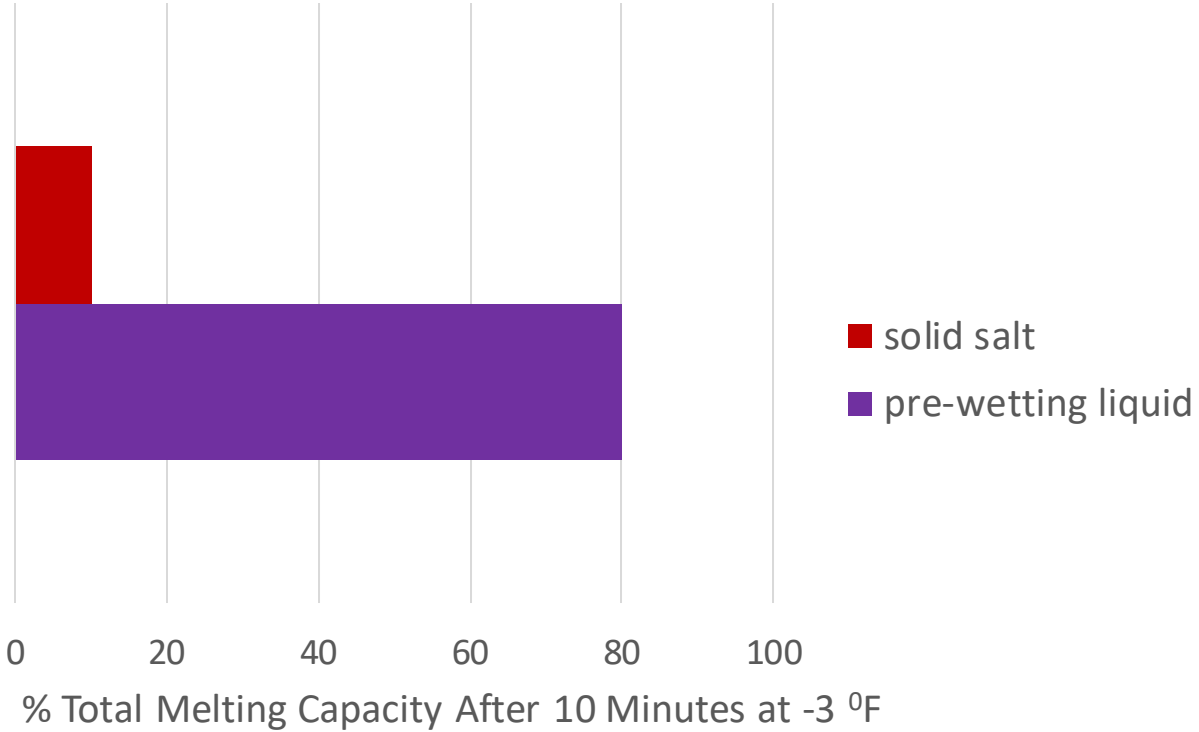
Ice Melt Due to Solid Salt-Only Prewetted with Different Brines at -3 ^{0}F (Maximum Brine to Salt Ratio)



Brine choice appears to matter!

Mixing (= traffic action) is also important!

What Happens When Pre-Wet Salt Contacts Ice/Snow?

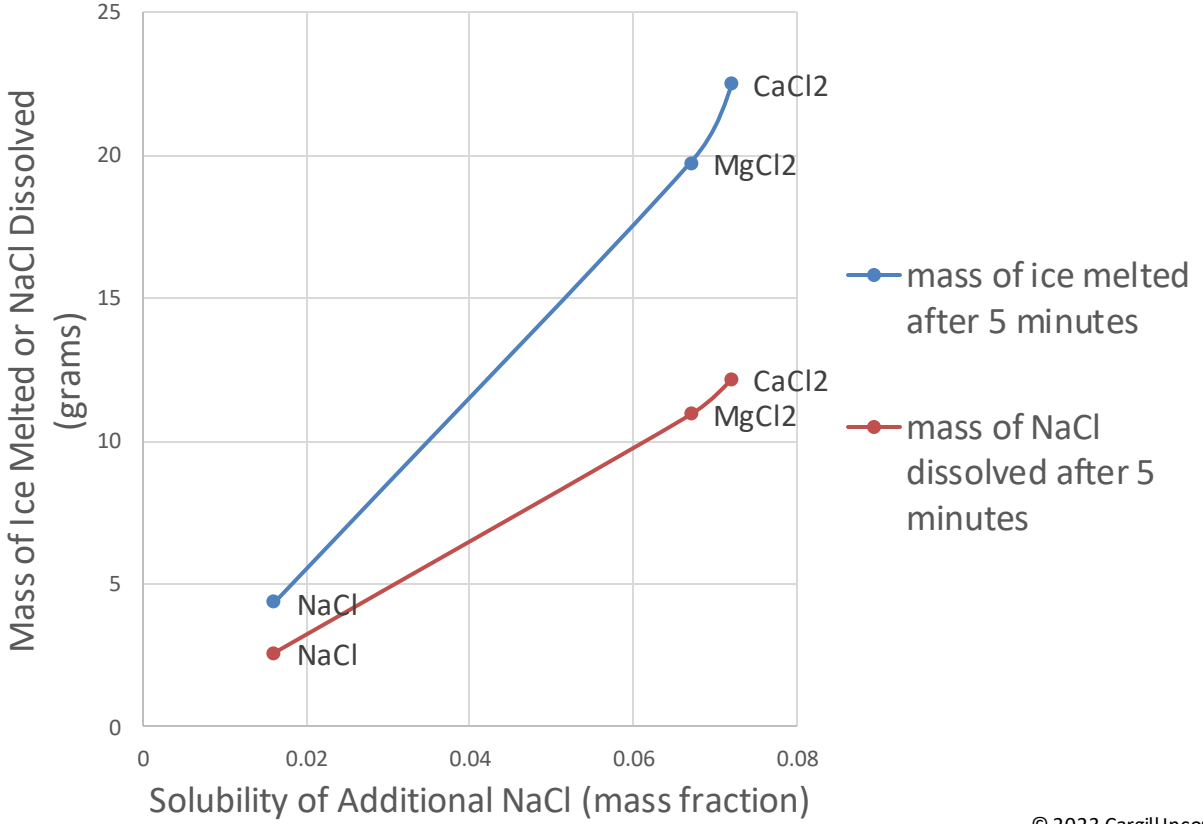


Step 1: Rapid ice melting by the pre-wetting liquid/slow dissolving of solid salt

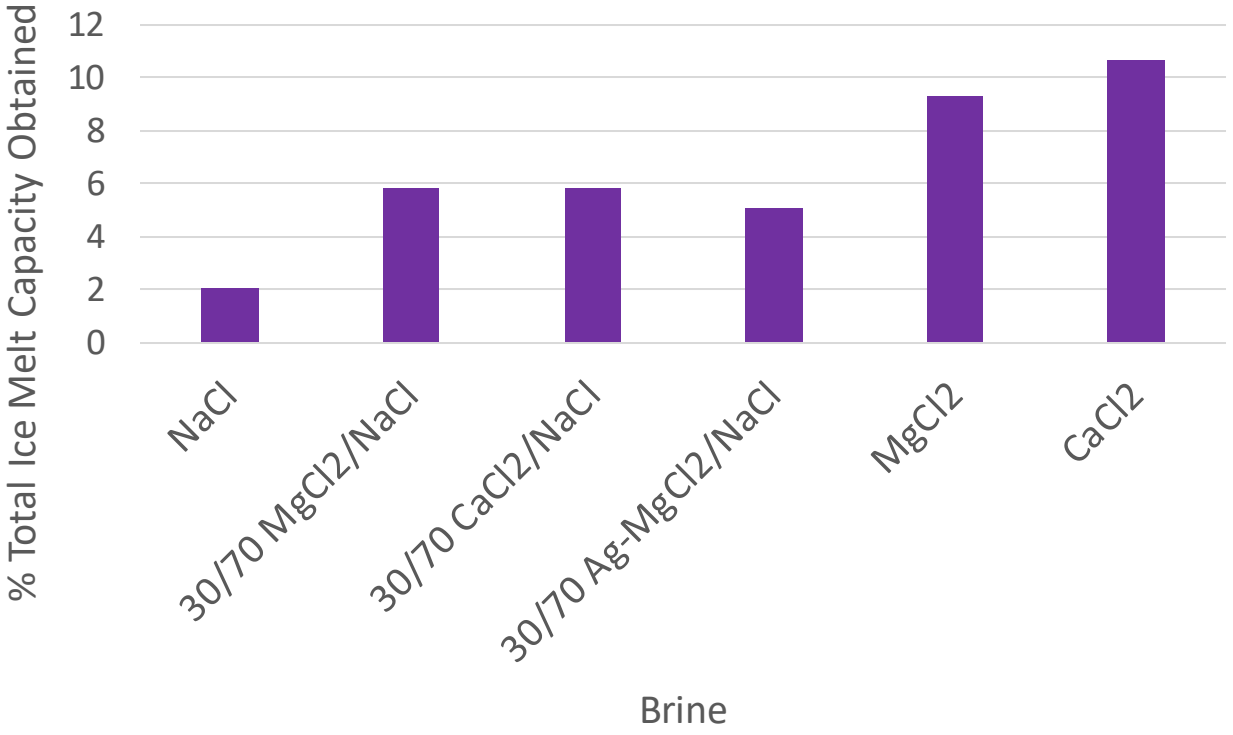
Step 2: Melting by liquid slows/solid salt dissolving increases

Pre-Wetting liquid is the “car” and solid salt is the “gas station”!

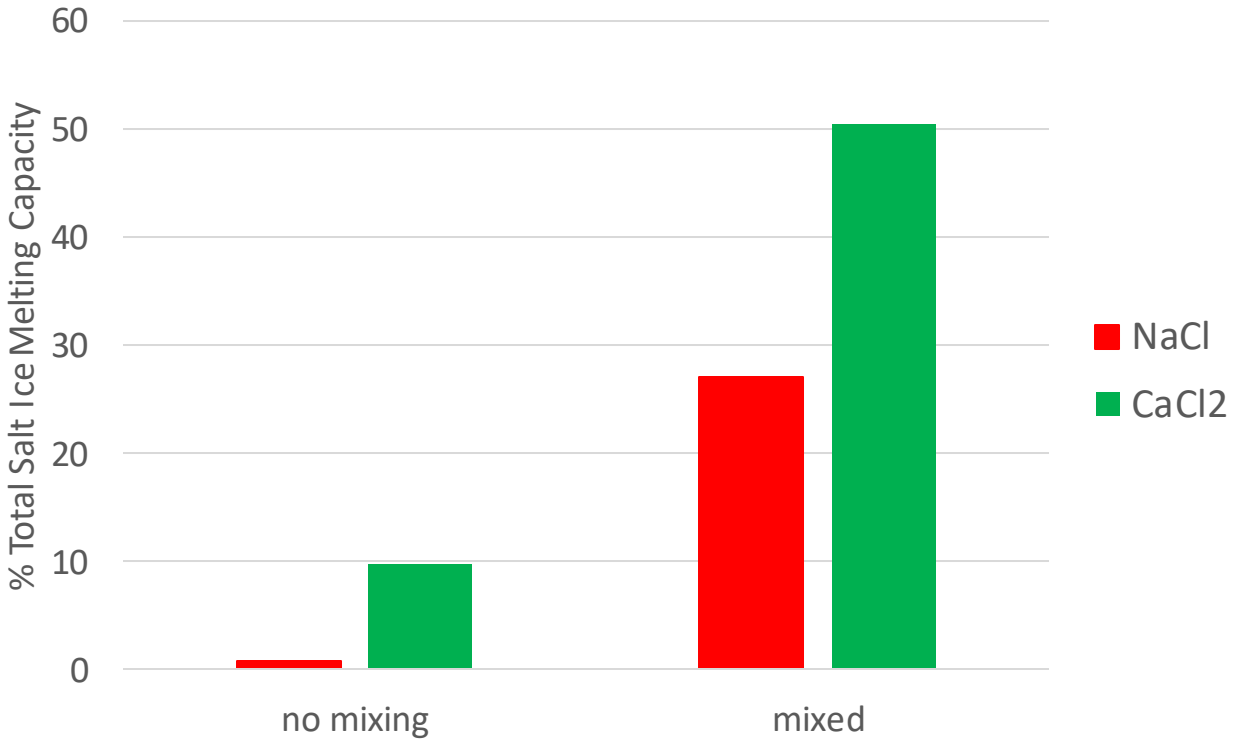
Continued Ice Melting Driven by the Dissolving of Solid Salt in the Liquid



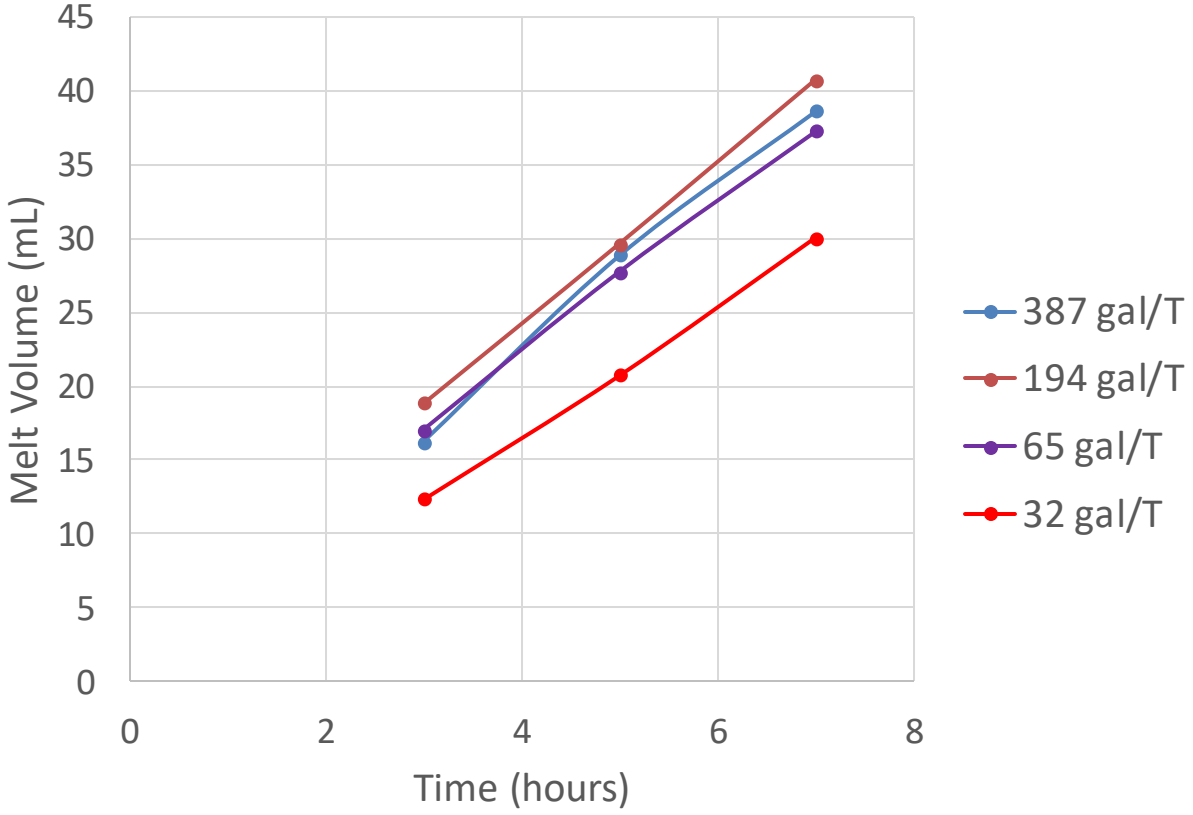
How much do brine blends help with ice melt speed? (testing max liquid:salt ratio at -3 ^{0}F)



What role does traffic action (mixing) play? (testing max liquid:salt ratio at -3 ^{0}F)



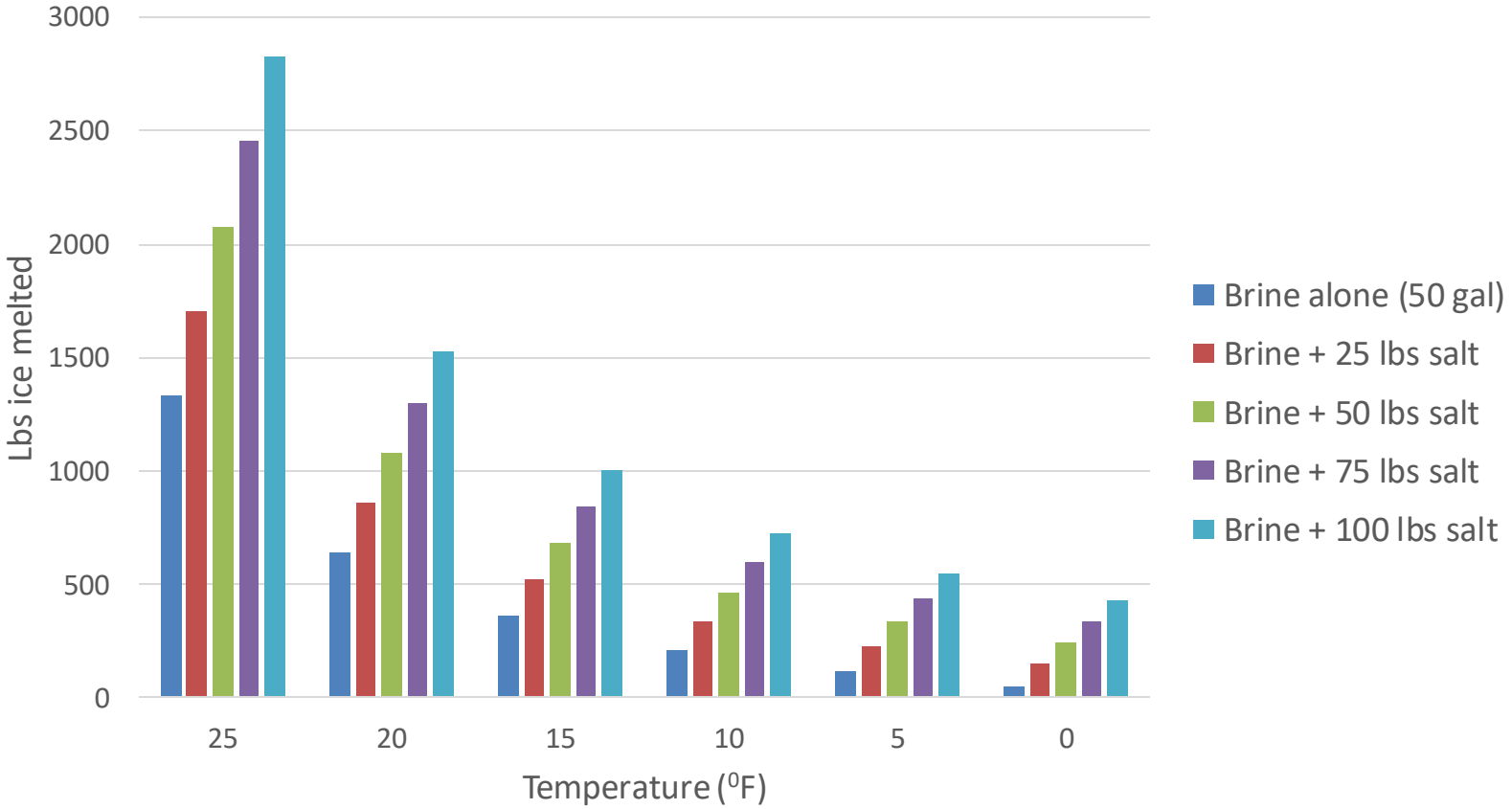
How much pre-wetting liquid is needed? (pre-wetting with MgCl2 brine at -4 ^{0}F)



Maximum ice melt speed occurs with maximum contact between ice and brine

Traffic action (mixing) should greatly decrease amount of liquid needed!

“Shake and Bake”



Questions?

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