Liquids – You Can't Afford Not To!

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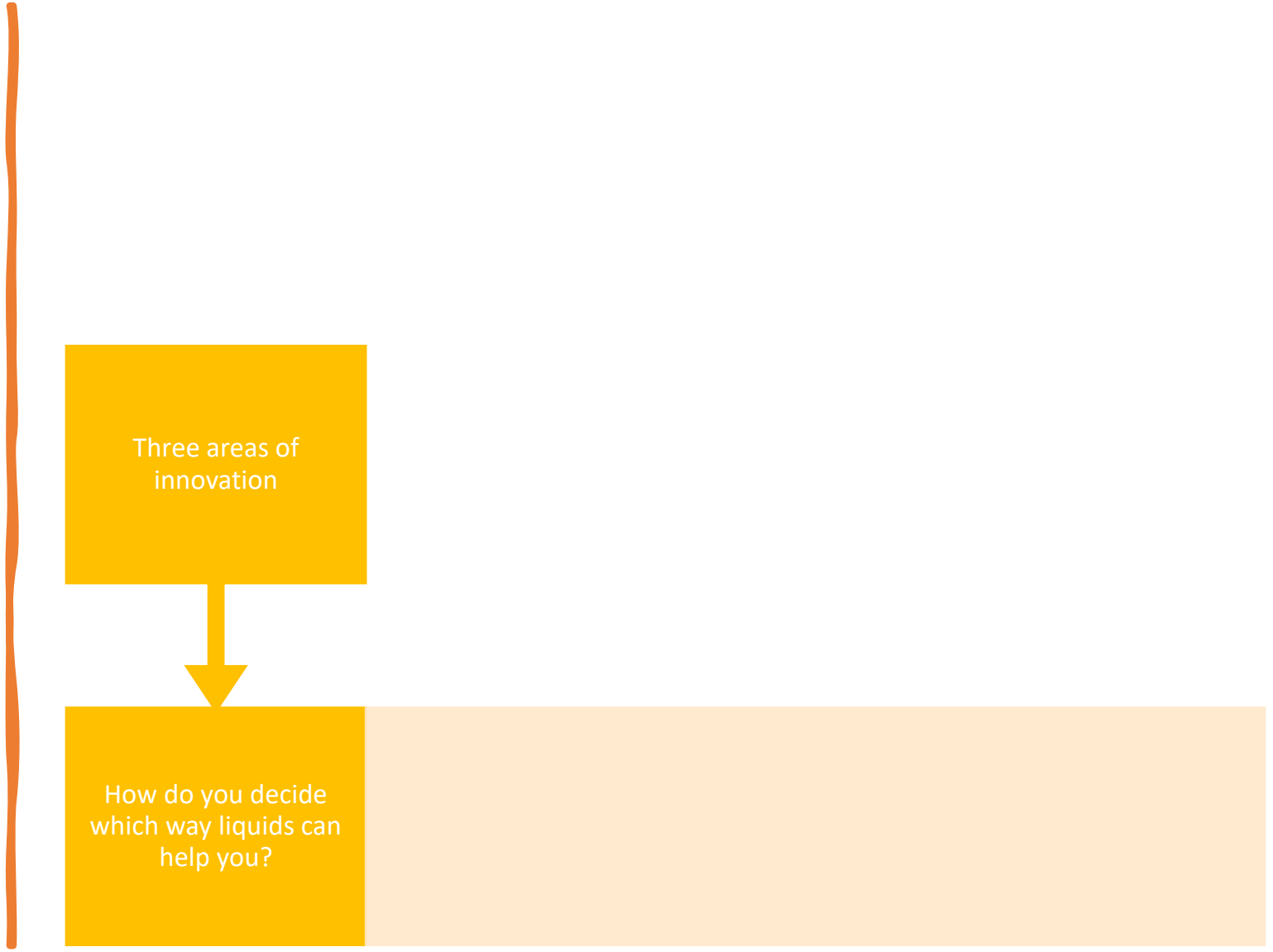
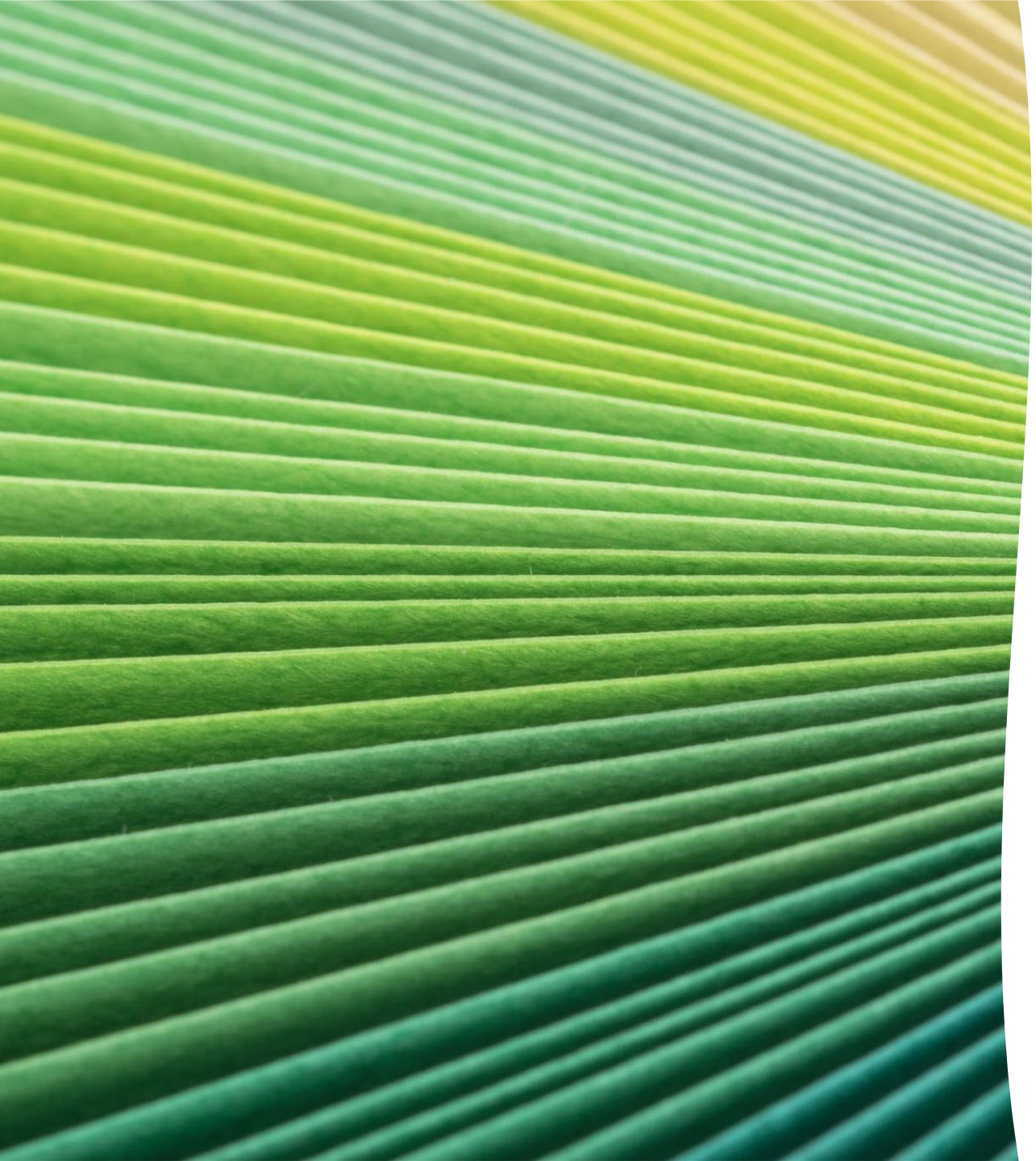
Professional Snowfighters Association

Agenda


Three areas of innovation
How do you decide which way liquids can help you?



What Has Changed?

- Lots more agencies are using liquids
- So, lots more has been learned about how to use them well (and how not to use them)
- We are using liquids in new ways and under new conditions
- Liquids are a tool, and we are learning better ways of using that tool
- Lots of info about blending too, but that is not our focus today (although it may come up!)

The Way Things Were

”below 15 salt shouldn’t be seen”

Pre-wet at the spinner at rates of 10 gallons per ton at most

Only use direct liquid application prior to storms, in an anti-icing mode, at rates of 50 gallons per lane mile or less

And expect those liquid applications to only last a couple of days at most

The Way Things Are Now

People using salt brine at pavement temperatures as low as 5 F (with appropriate care…)

Pre-wet rates as high as 90 gallons per ton, creating slurries, and going even further using two trucks (one following the another directly) to do “shake and bake”

Direct Liquid Application (DLA) being used (under certain circumstances) throughout storms, replacing the use of pre-wet solid salt

Persistence is being extended from 24-48 hours up to 7 days by using carbohydrates for blending

Lower the freezing point of water

So, that means they melt ice, right?

NO – I mean yes, but NO!

What then!

Deicers – what they do and how they work

1

We get rid of the snow by plowing it off the road

2

The deicer's job is to make it easier to plow

3

That means it has to work at the bond between the snow and the road

4

Ideally we stop that bond from ever forming, but sometimes the bond forms and we have to break it.

How do those deicers work for us then?

We break th
wit ers, we
ght melt the snow

Bond, Ice Bond

Need to get the material to the interface – the bond – between the snow and the pavement

Need to get it working right away

Need to keep it there to stop that bond from re-forming (re-freeze)

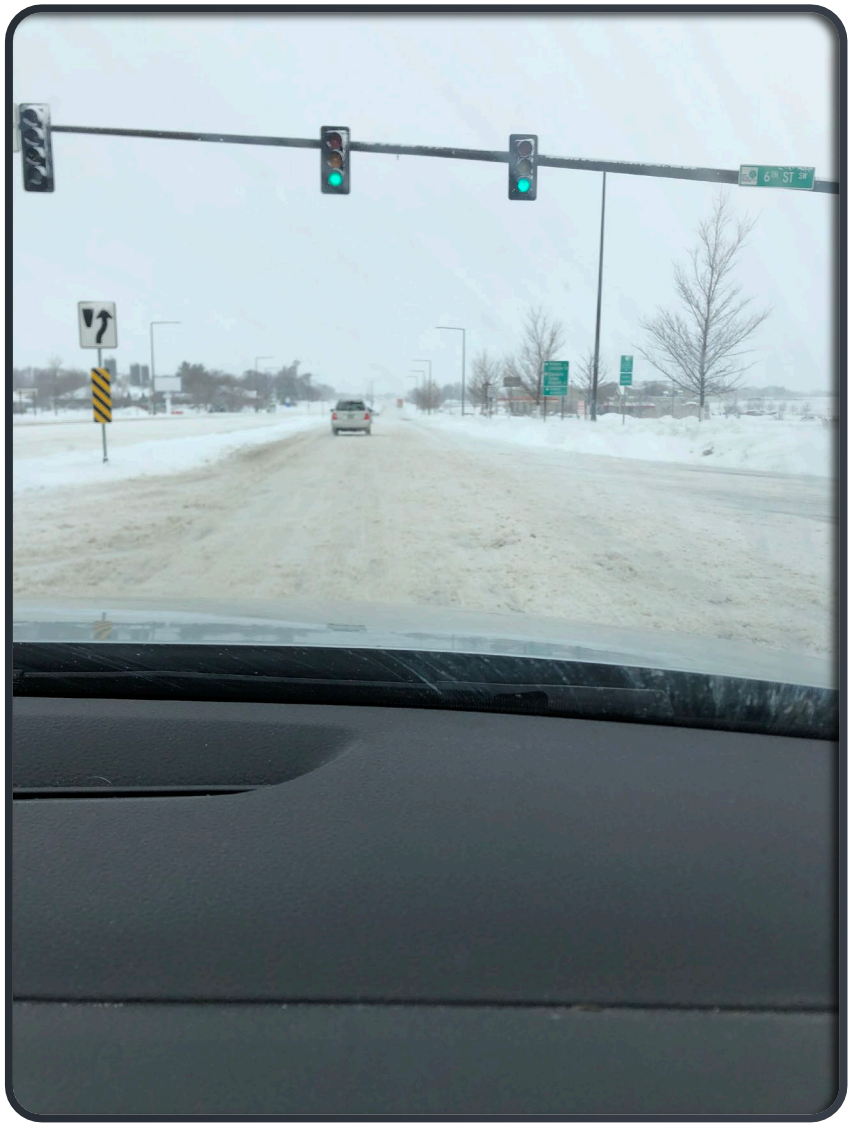
If that’s how they work, how should we use them?

Wait – what's this about "Get it working?"

TO DO THE TRICK WHERE WE LOWER THE FREEZING POINT AND THUS BREAK OR PREVENT THE BOND, THE SALT (OR OTHER SOLID CHEMICAL) MUST GO INTO SOLUTION.

THAT TAKES TIME – WHICH SOMETIMES HELPS – AND IT NEEDS MOISTURE TO DO IT, SO IF YOU ARE DEALING WITH A VERY DRY SNOW, THINGS CAN HAPPEN VERY SLOWLY – NOT ALWAYS GOOD

SO, WHEN IT IS WORKING, IT HAS GONE INTO SOLUTION – IT IS A LIQUID!



Liquids pros and cons

It acts really fast

It gets put down right on the pavement

It is a great preventative

- It dilutes out really quickly
- It gets washed away by rain
- But you have to act based on the forecast

Looking at Those Lower Temperatures

Pounds of Ice Melted Per Pound of Salt	
Temperature Degrees F	One Pound of Sodium Chloride (Salt)
30	46.3 lb of ice
25	14.4 lb of ice
20	8.6 lb of ice
15	6.3 lb of ice
10	4.9 lb of ice
5	4.1 lb of ice
0	3.7 lb of ice
-6	3.2 lb of ice

- Concern about the rate at which the salt starts to work
- Strongly influenced by the time it takes for solid salt to go into solution

So How Do Liquids Help Us with Lower Temperatures?

- They greatly accelerate the rate at which the solid salt works
- That means they can be effective at lower temperatures
- The main issue at lower temperatures is that the salt gets swept off the road before it can work
- The liquid stops that happening and so allows us to use salt at lower temperatures
- BUT…

The Challenge with Lower Temperatures

- Make sure you know what the pavement temperature is going to be – especially which way the trend is
- If things are going into the deep freeze, the salt is going to make things worse
- If things are warming up (e. g. if it is early morning and the sun is going to be shining) probably OK
- At lower temps, you have less room for error, so make sure you stay on top of things…

High Rates of Pre-wetting (Slurries and “Shake and Bake”)

The more liquid we have with our solid, the more rapidly we will be able to break the bond and deal with heavy accumulations of ice and snow-pack

Don’t just “get it wet” – get it “sopping wet”

Primarily used when you are de-icing (the snow has bonded to the pavement, so you got to break that bond)

The challenge is equipment - but this can be managed fairly easily

What Equipment Do You Need?

- Trucks that carry both solid salt and 900 gallons of salt brine (or other liquids)
- But what if you do not have that?
- Go the shake and bake route
- Typical solid salt application truck (use pre-wet salt so that it does not bounce and scatter)
- Follow with a liquid truck
- Make sure your liquid application rate makes sense (at 200lbs a lane mile, 10 gallons a lane mile is 100 gallons per ton)

Liquid only routes

Been in use for about 10 years now

General approach, pre-treat as for anti-icing (50 gallons per lane mile/GLM)

Then during storm apply at higher rates (typically 100 GLM)

Anti-icing versus liquids only

Anti-icing

- Direct liquid application prior to storm
- Subsequent in-storm applications done as pre-wet solid material
- Stops initial bonding between snow and pavement
- Provides a “safe time” at the start of the storm
- Savings of up to 75% in comparison with reactive treatments

Liquids Only

- Direct liquid application prior to storm and throughout the storm – no use of solids (except in unusual conditions)
- Stops initial and subsequent bonding, provided cycle time is short enough
- Provides a “safe time” throughout the storm
- Savings of up to 50% in comparison with anti-icing

When to consider liquid only

- Best practice suggests when cycle times are short (90 minutes or less)
- Also work well in cases with high traffic volumes (often have shortest cycle times)
- Need to consider limitations due to:
  - Pavement temperature ranges
  - Precipitation type

Hard data to support this?

From Wisconsin DOT

Note there is also a ClearRoads project on this too…

https://clearroads.org/project/16-06/

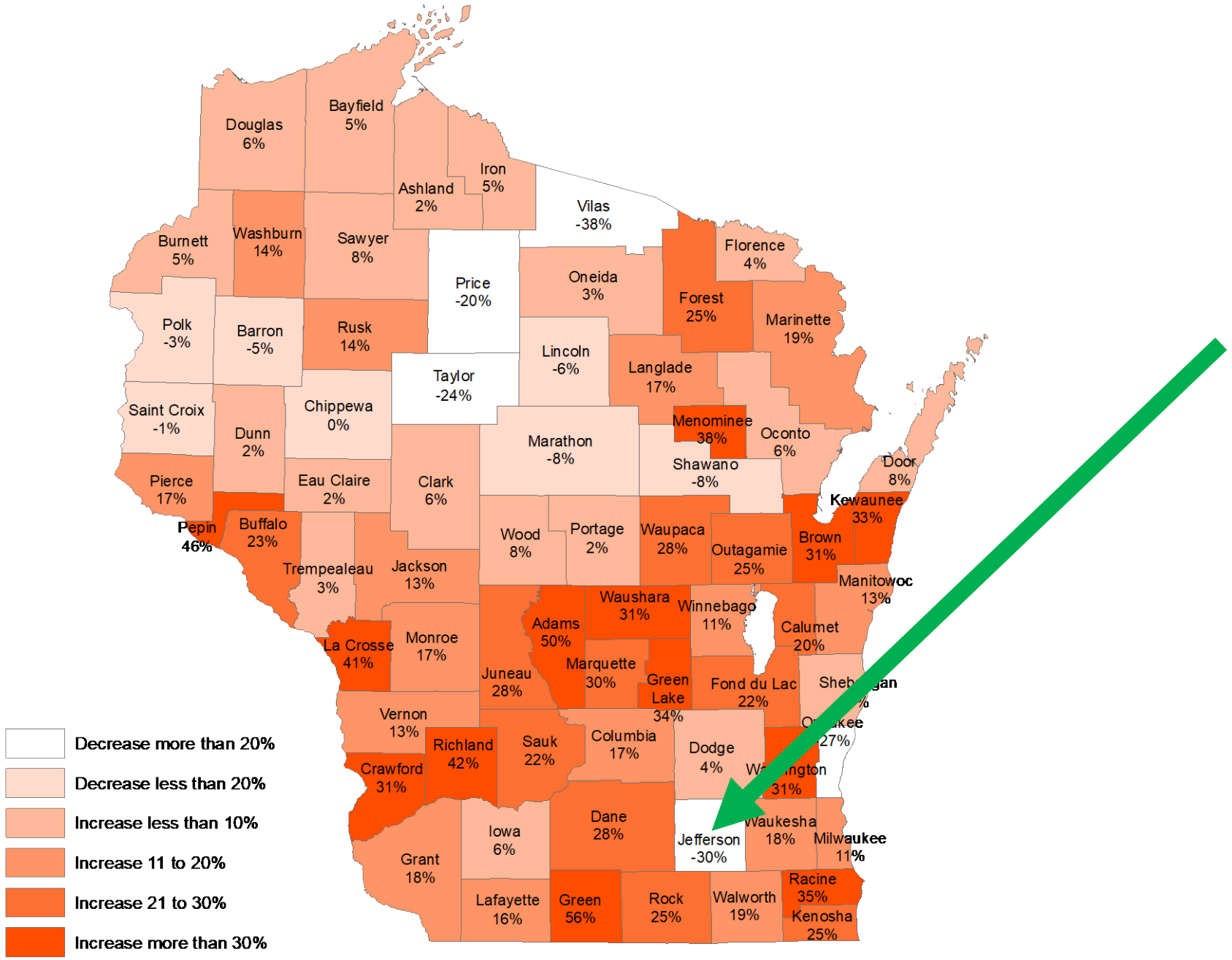
https://clearroads.org/project/identifying-the-parameters-for-effective-implementation-of-liquid-only-plow-routes/

Jefferson County 2018/2019

- Reduction of **52.9%** in salt use (over 5-year average using winter severity)
- Averaged **1,468 gallons** of brine per lane mile (Iowa ~1,324 gal/lm)
- At $74.53/ton saved the State **$427,496** in salt purchase
- Extra Cost to produce the brine was ~ $45,000
- Jefferson County reported saving $206,000 on their county system
- Jefferson below region average labor and equipment costs AND salt use!

	Southwest Region Average per Lane Mile	Jefferson County results per Lane Mile
Total Labor Cost	$800.36	$652.53
Total Equipment Cost	$978.55	$904.52
Total Salt Used (including salt used in brine)	17.19 tons	9.31 tons

Figure 3.10. 2018-2019 Salt Use per Lane Mile vs. 5-Year Average



During Storm Direct Liquid Application Results

Scientific Data: [B-5]3/19/13

(straight salt brine) 45 gplm wind 1mph-WSW/ dp 18 pave 16°F/ ⅓" snow/ 9:45 am/ Lt. snow during application/ Lt Traffic/ Concrete Surface No Blading Cloudy/Overcast

Measured material usage per l/m

DLA Post-treatment 45 gal **103 lb salt**

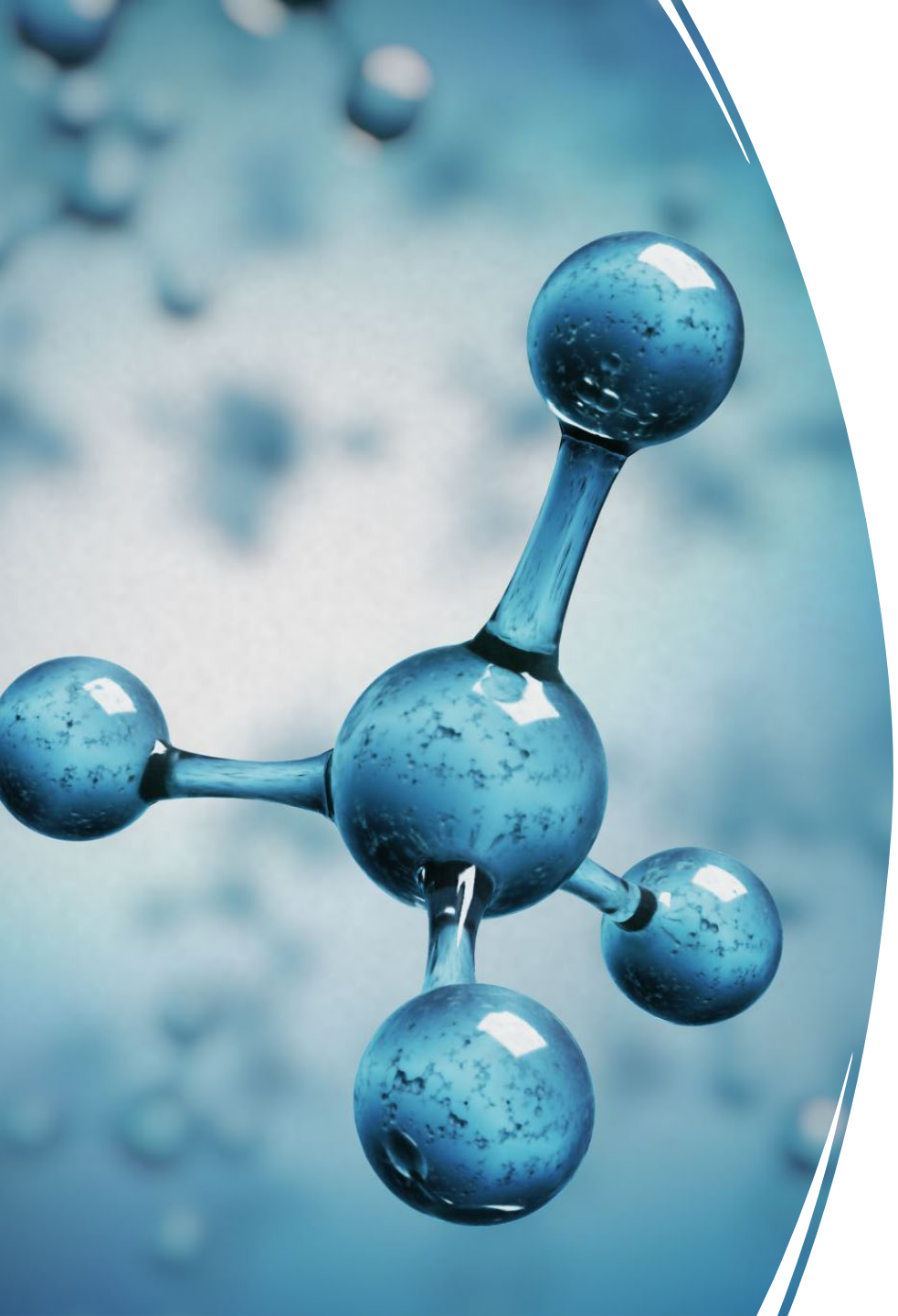
Traditional Salting est. **300 lb salt**

65% Reduction in Salt/Cost

LTAP - Bridging the Gap Between Research and Practice, SE MI Winter Maintenance Team 2013 Bryan Pickworth, City of Farmington Hills - Matt Wiktorowski, City of Novi – Mark Clancy, City of Wixom & Mark Cornwell, Sustainable Salting Solutions, LLC

limitations

- Not good for ice storms
- Not good when pavement temperature drops below range for liquid
- Does not require additives (e. g. agricultural by-products) but many find them helpful

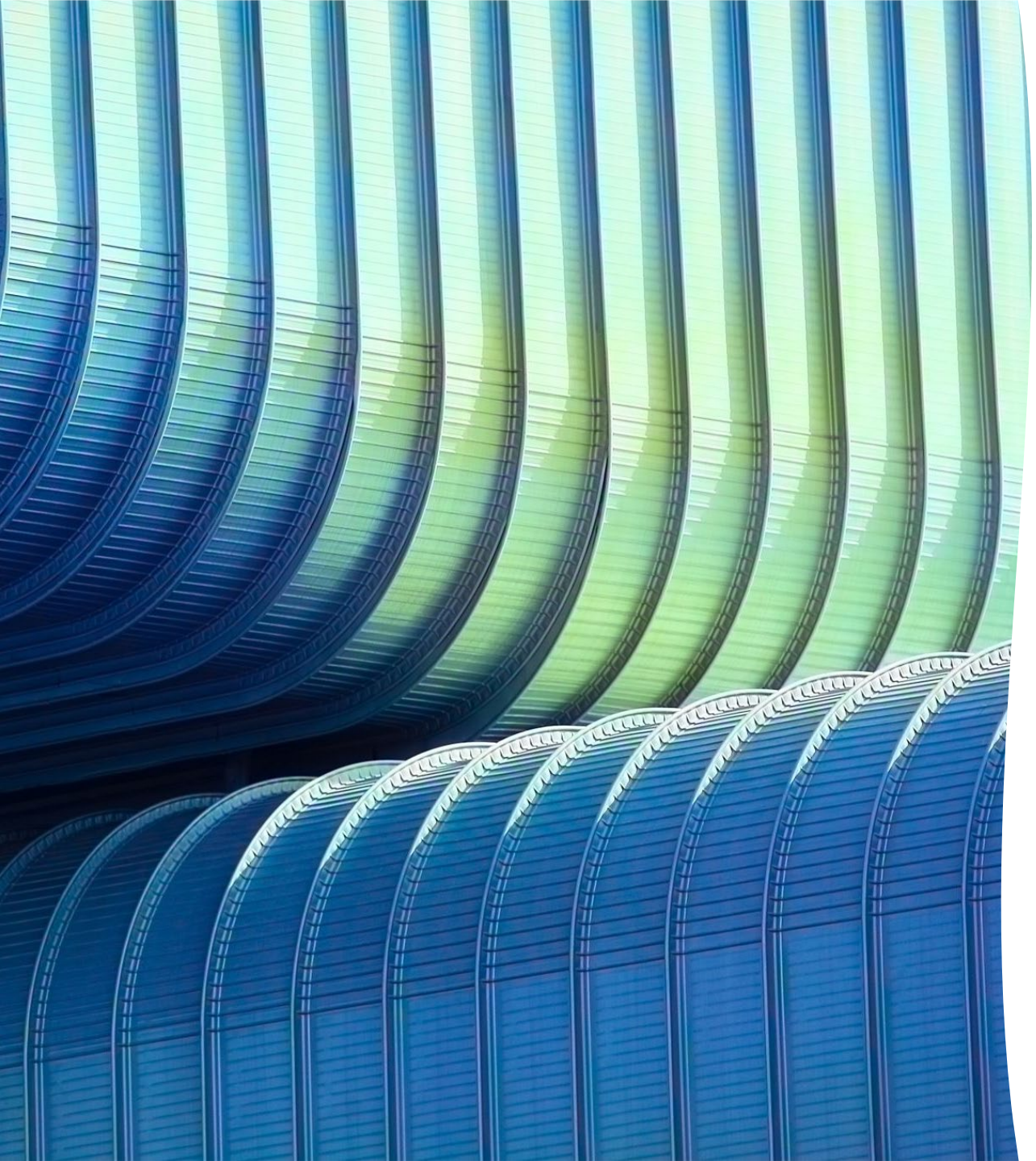


Liquids and Blending

- Primarily adding “a little bit” of something to salt brine to improve performance
- What sort of something?
- Carbohydrates
- Other chlorides

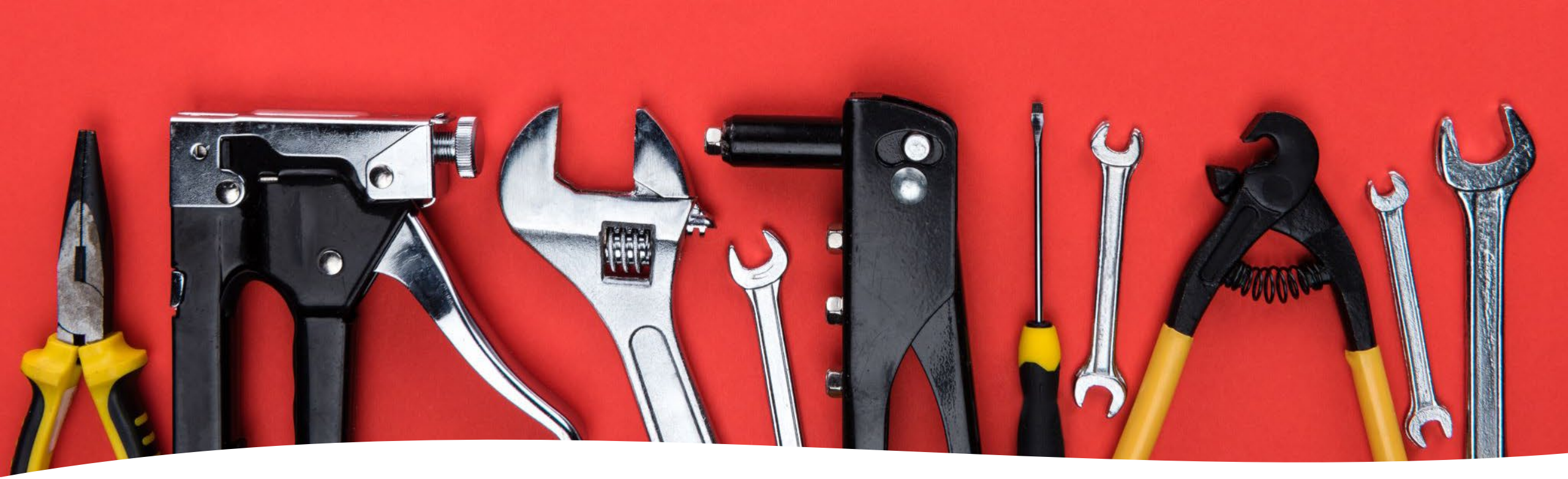
What Sort of Improvement?

- Better persistence on the road
- Reduced corrosion
- Improved melting performance
- Are these real?



Real or Not?

- Not necessarily easy to measure
- Persistence seems real
- Corrosion definitely works in the lab
- Improving performance is difficult to realize when you are only adding 10% of the ”superior” product



Conclusions

- Liquids are just another tool in our winter maintenance toolbox
- But they allow us to stretch our operational parameters beyond the traditional ranges
- Of course, we have to use them with care, especially when we are going beyond those traditional boundaries, but
- Used appropriately they are great tools that allow us to achieve our level of service goals more efficiently and more effectively