Liquid Use for Winter Operations

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32 years of MDOT winter operations experience

BOOST™ with Calcium Chloride

How to Use Liquid Anti-Icers

Basic Stratigies

Anti-Icing: is a snow and ice control strategy for prevention of a strong bond between frozen precipitation or frost and a pavement surface by timely application of a chemical freezing point depressant.

Deicing: is an operation where a treatment of a deicer is applied to the top of an accumulation of snow, ice, or frost that is already bonded to the pavement surface.

Anti-Icing = Proactive

Deicing = Reactive

Understanding how deicers work and establishing realistic expectations are critical to a successful program.

How to Use Liquid Anti-icers

Anti-Icing Prior to a Storm

On Board Pre-Wetting System
(At the Spinner)

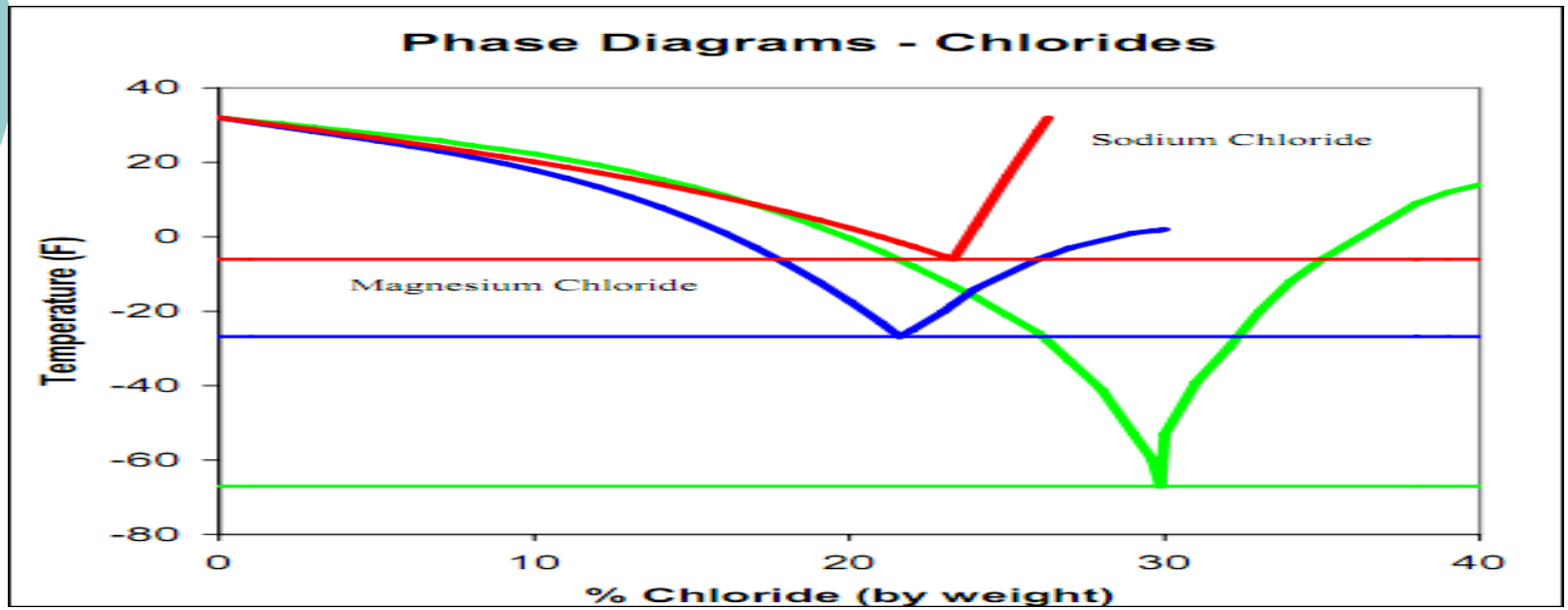
How to Use Liquid Anti-Icers

Temperatures

- **<u>Effective Temperature:</u>** is the lowest temperature in which the cost of the application is justified by the results obtained.

- **<u>Eutectic Temperature:</u>** is the freeze point of a solution based on the percentage of chemical in the solution and not the volume.

How to Use Liquid Anti-Icers



All ice control products work the same. Their function is to lower the freeze point temperature of water. This is dependent on the percentage of chemical in the solution and is expressed as the <u>eutectic temperature</u> of the solution.

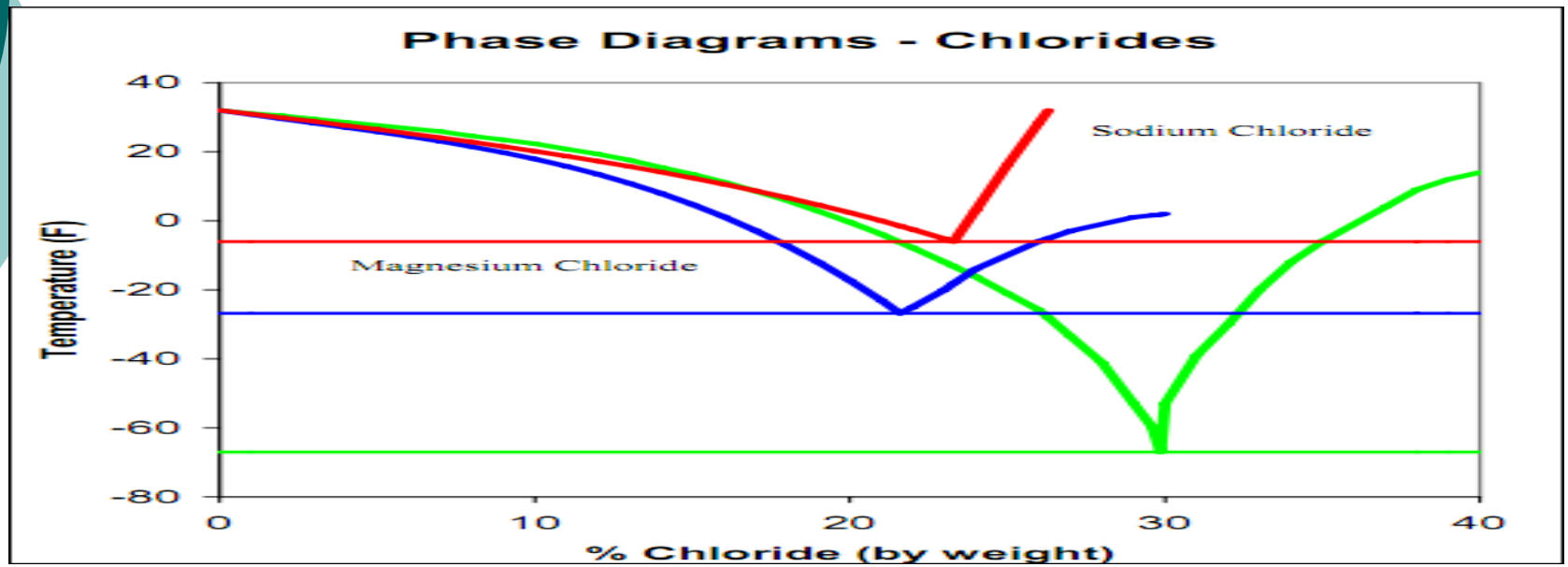
How to Use Liquid Anti-Icers

Cooling System Capacity (Quarts)	Quarts of Antifreeze Required for Protection to the Given Temperature											
	1	2	3	4	5	6	7	8	9	10	12	13
8				-34								
9	24	14	0	-21	-50							
10	25	16	4	-12	-34	-62						
11	26	18	8	-6	-23	-47						
12		19	10	0	-15	-34	-57					
13		21	13	3	-9	-25	-45	-66				
14			15	6	-8	-18	-34	-54				
15			16	8	0	-12	-26	-43				
16			17	10	2	-8	-19	-34				
17			18	12	5	-4	-14	-27				
18			19	14	7	0	-10	-21	-34	-50	-65	
19			20	15	9	2	-7	-16	-28	-42	-65	
20				16	10	4	-3	-12	-22	-34	-48	-62

Let’s say you have a 12 quart capacity radiator system. A 50/50 mix of anti-freeze (6 qts.) and water (6 qts.) = protection down to -34 degrees.

With only 3 qts. Of anti-freeze / 9 qts. of water (25%) you only have protection to +10 degrees.

How to Use Liquids Anti-Icers



This holds true for all ice control products. As concentration changes, so does the melting temperature of the material.

Some products actually dilute to its optimum **eutectic temperature**.

But, as these products continue to melt snow, it creates water and continues to dilute the concentration. As concentration changes, so does the melting temperature of the material.

Know Your Product

- Remember, the effectiveness of any deicing chemical is dependent on four factors:
- 1)Surface Temperature
- 2)Application Rate
- 3)Moisture, and
- 4)Beginning Concentration.

Know Your Product

- D.O.S. – Dilution of Solution.
- As the concentration of a solution changes, so does the temperature at which it melts ice – D.O.S.
  - Understanding DOS provides the key for understanding how ice control products work.
  - Specifically, an ice control product will work until the eutectic temperature of the solution meets the pavement surface temp. At this point, the material will stop melting and you may experience refreeze.
  - Refreeze occurs when an ice-control product dilutes to the point that it can no longer melt ice at the given surface temperature.

Know Your Product

- D.O.S. also explains why one application rate will not fit all storm events. The temperature and moisture of each storm event varies; therefore, the application amount needed to control each storm varies.

Why Use Liquids? Fun Facts

- MDOT contracts with 66 counties and 150 cities & villages to perform winter maintenance
- 27 MDOT garages
- 350 MDOT snow plows
- Average winter expense-$80 million
- Average salt usage-650,000 tons

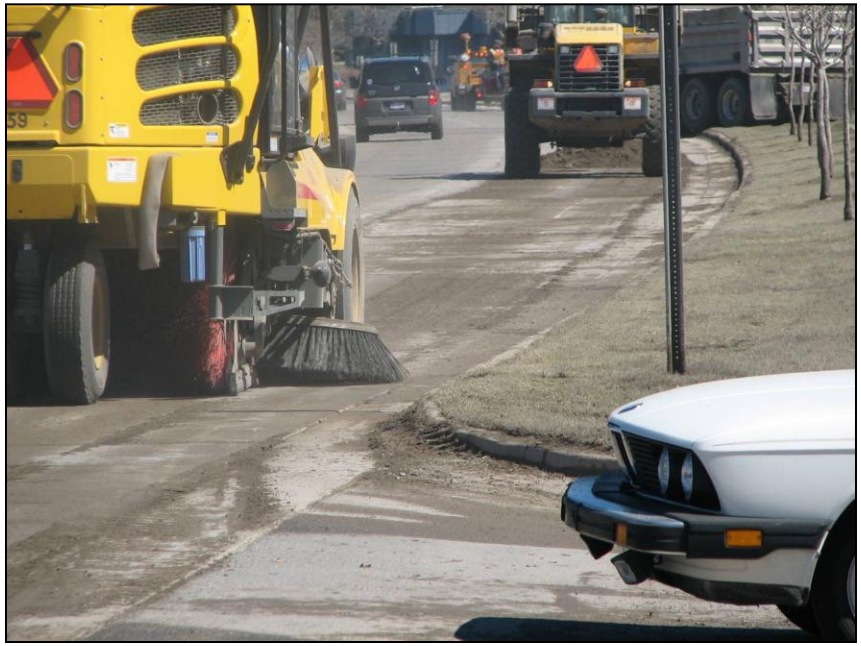
Why Use Liquids? Fun Facts

- MDOT statewide average price for 2009 - 2010 was $61.00/ton
- Price increase of 25% average annually
- Increase of 108% over 2004-2005 prices

Why Use Liquids?
Fun Facts

- Using liquids led to overall decreased material costs
- Prewetting salt reduced its use by 28%-38%
- Prewetting salt also reduced abrasive (Sand) use by 78%
- Cost savings of prewetting salt reduced material cost by an average of $1.69 per mile

Why Use Liquids?
Fun Facts



- MDOT spent $600,000 on cleaning catch basins, $725,000 on curb sweeping in FY 2009.

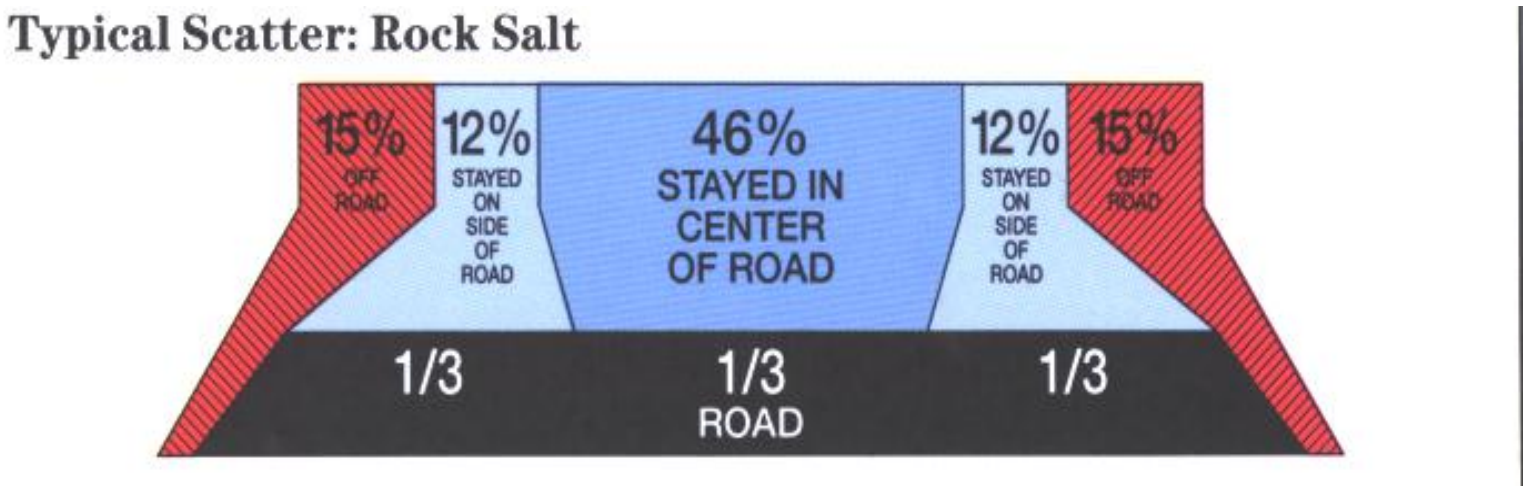
What is Prewetting?

- Using a liquid to wet salt before it is applied
- Typically applied at 8-10 gal/ton of salt (if using salt brine rates will be higher)
- Prewetting has been used since the 1960s
- MDOT tested and approved prewetting in the early 1970s
- Widely accepted as a maintenance best practice in North America

What Does Pre-Wetting Do ?

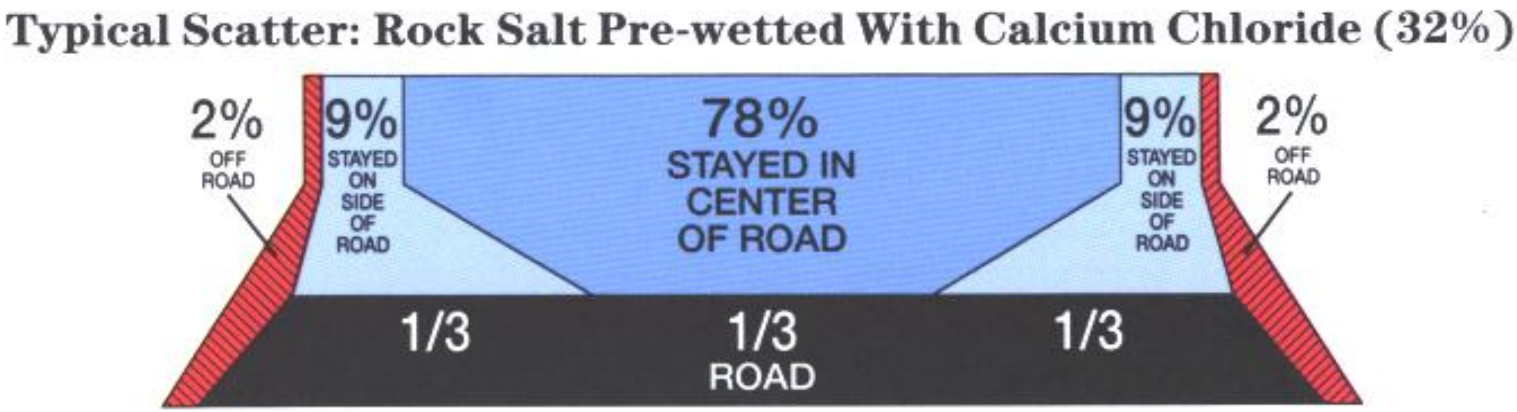
- Salt works colder (still use sensible salting guidelines)
- Salt works faster
- Reduces bounce and scatter
- Application rates can be reduced
- Reduces sand use
- Quicker “burn in” of sand or sand/salt blend to enhance traction
- Prolongs effectiveness of sand applications
- Reduces "white dusting" when application dries

Bounce & Scatter Study



When spread down the center of the road, only 70% of the rock salt stayed on the road, and 46% stayed in the center of the road.

Bounce & Scatter Study



When spread down the center of the road, 96% of the solid NaCl prewetted with $CaCl_2$ stayed in the road, and 78% stayed in the center of the road.

Bounce & Scatter Study

Untreated as much as 30 – 50% of applied salt can be wasted.

MDOT Liquid Use Study Conclusions

- Using liquids led to overall decreased material costs
- Prewetting salt reduced its use by 28%-38%
- Prewetting salt also reduced abrasive use by 78%
- Cost savings of prewetting salt reduced material cost by an average of $1.69 per mile
- **Every 1000 tons of salt saved can create or save a drivers job !**

Liquid Use - Quiz Time !

- How Much Salt Do You Use?
- Per Year?
- Per Lane Mile?
- What Is Your Cost Per Ton?

- How Much Sand Do You Use?
- What Is the Sand Clean Up Cost?

- Can You Afford <u>Not</u> to Use Liquids?

Type of Liquid You are Using

- Agricultural bi-product (ABP's)
  - Generally mixed with Calcium Chloride to lower freeze point
  - ABP's treated liquids stick to salt better
  - Contains corrosion inhibitors
  - Provides viscosity to keep chlorides on the pavement
  - Speeds storm cleanup by preventing bond of snow and ice to pavement.
  - MDOT uses in most direct garages

Types of Liquids

Caution – not everything melts ice!!!

Some organic additives (e.g. sugars, **carbohydrates**, certain proteins) work like cryoprotectants

Cryoprotectants inhibit the freezing of water, the cryprotectants prevent actual freezing, and the solution maintains some flexibility in a glassy phase.

Used in ice cream/popsicles to prevent ice crystals or to keep from freezing like ice cubes, they also occur naturally in arctic fish and plants

Types of Liquids – Know your Product

Caution – From the Headlines!!!

- **Michigan may join other Great Lakes states in restricting phosphorus**
- Some algae blooms have led to large fish kills in West Michigan. One environmental group issued a report saying a single pound of phosphorus can stimulate growth of up to 500 pounds of algae.
- Monday, October 04, 2010 - Grand Rapids News

Types of Liquids
Brines.

- Salt Brine – Typically made by road agency. High application rates. Same temperature range as rock salt. Actual cost are deceiving

Types of Liquids
Brines

- Mineral well brine – Typically pumped from wells and stored in open lagoons. High application rates. Inconsistent chloride percentages. Performance varies as % changes. Actual cost are deceiving.

Types of Liquids Brines.

- Oil field brines – A by product of oil production. Regulated by MDEQ, contains BTEX, known carcinogens.
- Very low percentages of chlorides.
- High freeze points.
- One agency does not apply at temperatures below 24 degrees F.
- High application rates, minimal, if any performance gains.

How to Prewet

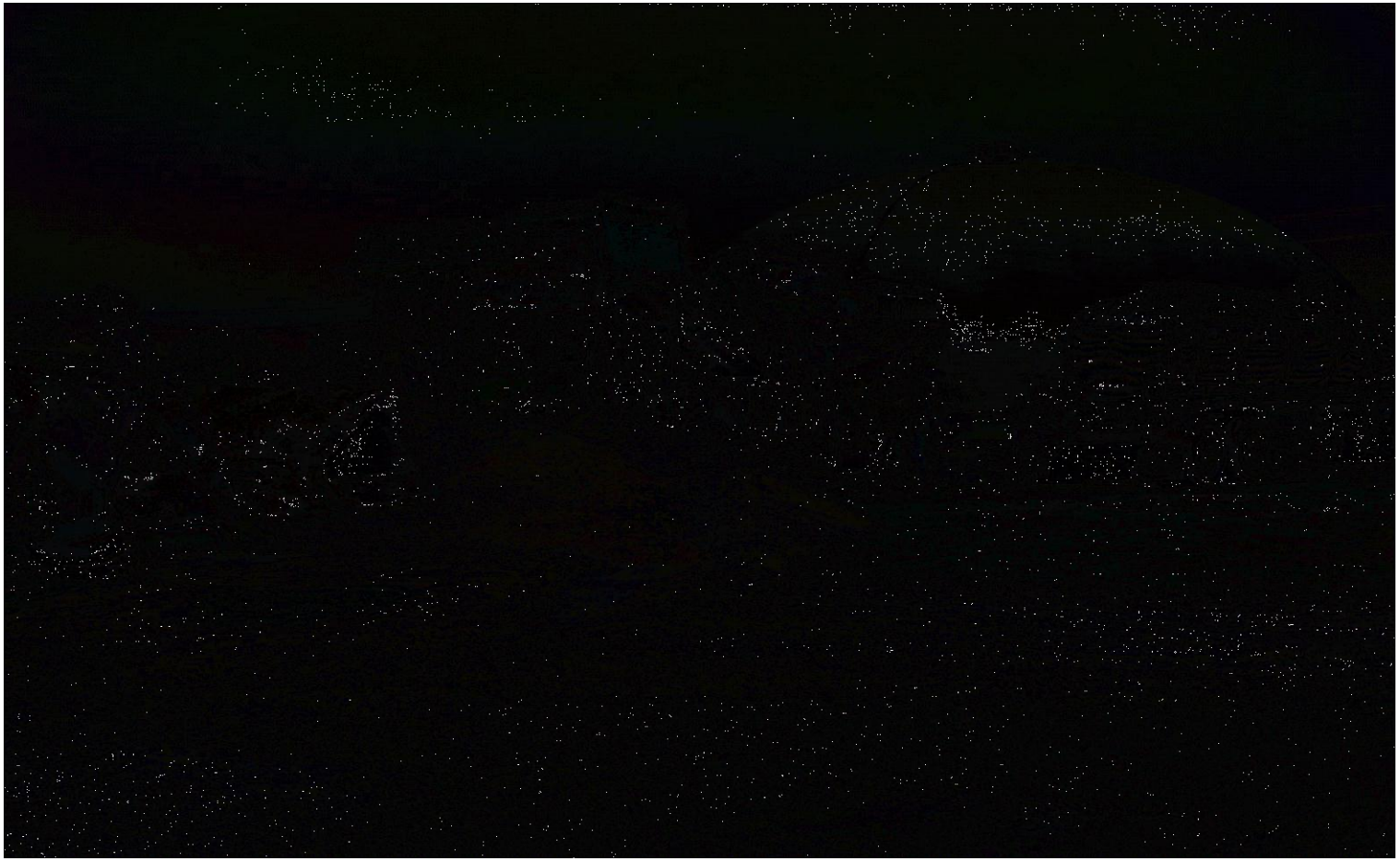
- Vendor Treated Stockpile
- Entire Stockpile
- Batching
- Load Treatment
- On-board Prewetting

Vendor Treated Stockpile

Vendor uses pug mill to mix salt and liquid evenly before or during delivery:

- Pros: No spray equipment to purchase or onsite chemical storage, ensures that all salt used is prewet for the season, no additional equipment on trucks
- Cons: Stockpiles must be covered after treatment, leaching of chemical may occur

Vendor Pre-Wetting Stockpile



Treat Stockpile at Delivery

Garage or agency treats entire salt stockpile during or immediately after accepting delivery using a wand or hose:

- Pros: Ensures that all salt used for the season is prewet, don’t need extra equipment on trucks
- Cons: Difficult to evenly coat all salt with liquid, liquid may leach out of pile, stockpiles must be covered after treatment.

Batching

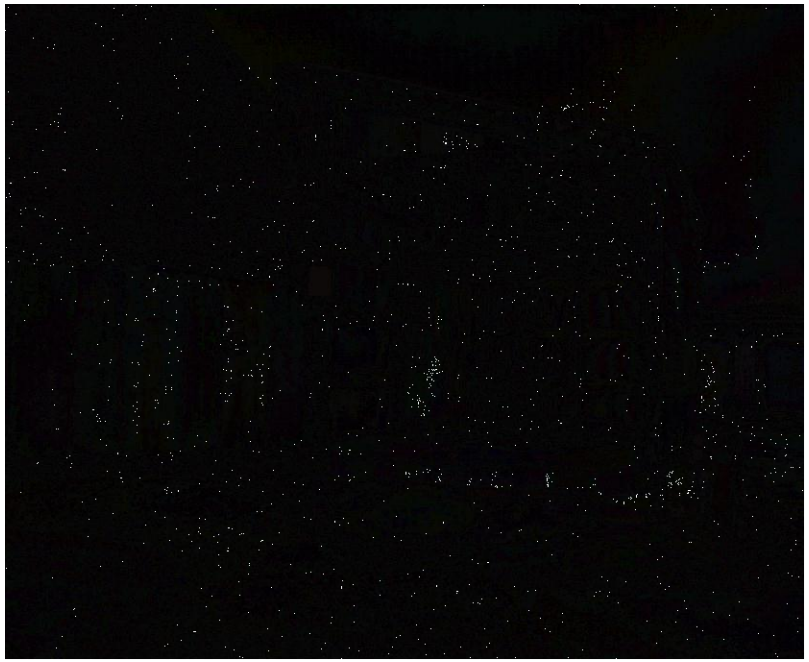
Mixing up enough prewet salt for one storm, typically with a front end loader:

- Pros: No additional equipment on trucks, salt is typically prewet before storm starts
- Cons: May deplete prewetted stockpile before storm ends, difficult to evenly coat all salt with liquid

Treating Every Load

Spraying liquid on a load via overhead spray bar

- Pros: No additional equipment on trucks, easy to use
- Cons: May be more corrosive to equipment, difficult to evenly coat all salt with liquid



On-Board Prewetting

Using an on-board spray system to treat salt as it is being discharged from truck:

- Pros: Operator can decide when to prewet, salt is prewet evenly
- Cons: Equipment can cost up to $5,000/truck and needs to be maintained

Pre-Wetting @ the Spinner

Know what the product is your getting.

Field inspection, unloading, sampling, and testing

BEFORE ALLOWING ANY PRODUCT TO BE UNLOADED, PERSONNEL SHOULD FOLLOW THE PROCEDURES LISTED BELOW.

A. INSPECTION

1. Document and maintain records on all deliveries, including those that are rejected.

2. Check to assure that the product is being delivered according to the terms of the contract. This includes but is not limited to the following:

a. Date of the order.

b. Date and time of delivery.

c. Verification of advance delivery notification.

d. Delivered within allowable times.

e. Name of Delivery Company and license plate numbers.

f. Is any price adjustment assessments required?

g. Is the product being delivered what you ordered?

h. Document all procedures prior to unloading of product.

i. Verify that all papers required of a delivery are present, complete, and legible.

3. Legible and current MSDS sheet.

4. Certified weight slip.

5. Accurate, complete, and legible bill of lading and/or invoice with the information as required in Section C Part 1.

Know What the Product is Your Getting.

- Quality Control:
- A good quality control program is essential to any reliable liquid program.
- The potential for innconsistencies in delivered products will result in inconsistent performance.
- Without a good QC program, performance results can differ, even though applications and circumstances are the same.
- Knowing the specific gravity of your liquid deicer is at the heart of a good quality control program.

Recap

- Environmental Issues:
  - Less Chlorides / Water Quality
  - Less Sand / Water Quality
  - Less Dust / Air Quality
  - Less Damage to Vegetation

Recap

- Safety Issues:
  - Fewer Accidents
  - Reduced Traffic Delays

Recap

- Economic Issues:
  - Reduced Sand Cost
    - Purchase
    - Mixing
    - Cleanup
    - Hauling to a Class II landfill
    - Cradle to Grave Cost for a Ton of Sand $500.00

Recap

- Economic Issues:
  - Reduction in total chemical cost
  - Reduced corrosion to equipment
  - Reduced corrosion to Infrastructure.
  - Lost business / revenues

Have a Safe Winter
Questions ??

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LIQUIDOW™ GLC Inc.