Alternatives for Reducing Chloride Loading from De-Icing
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Steven Kaar
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Reducing Chloride Loading

Why?
Purpose?
Goal?
Reducing Chloride Loading

- Plant Issues
- Water Issues
- Corrosion Issues
- Concrete Issues
MISSION STATEMENT

Establish and promote Best Management Practices for de-icing that minimize deterioration to buildings, infrastructure and the environment without compromising safety.
Generic De-Icers

- Aluminum Chloride
- Ammonium Sulfate
- Calcium Acetate
- Calcium Chloride
- Calcium Magnesium Acetate
- Ethyl Alcohol
- Ethylene Glycol
- Fertilizers
- Formamide (1:1:1)
- Isopropal Alcohol
- Liquid Calcium Chloride
- Lithium Chloride
- Magnesium Acetate
Generic De-Icers

- Magnesium Chloride
- Methanol (Methyl Alcohol)
- Potassium Acetate
- Potassium Carbonate
- Potassium Bicarbonate
- Potassium Chloride
- Potassium Phosphate
- Propyl Alcohol
- Sodium Chloride
- Sodium Formate
- Sodium Nitrate
- Sodium Sulfate
- Tetrapotassium Pyrophosphate
- Trisodium Phosphate
- Urea
Typical De-Icers

Chloride De-Icers
- Sodium Chloride
- Magnesium Chloride
- Calcium Chloride
- Potassium Chloride

Non-Chloride De-Icers
- Calcium Magnesium Acetate
- Potassium Acetate
- Urea

Frequent Additive: Carbohydrates
Manufactured By Product
Evaluating Alternative De-Icers

- Corrosion & Environmental Impact
- Application Rates
- Ease of Handling
- Odor
- Cost
- Availability
- Technical support from vendor
Phase Diagram for Typical De-Icers
BOD & COD

- **BOD** - Biochemical Oxygen Demand. A measure of how much dissolved oxygen is being consumed as microbes break down organic matter. A 5-day test giving indication of rate of oxygen take-up.

- **COD** - Chemical Oxygen Demand. COD is the amount of oxygen required to degrade all the organic compounds in a water solution. A 20-day test.

BOD is much more important than COD.
Phosphorus and Nitrogen

Why are phosphorus and nitrogen important?

Eutrophication - Water pollution caused by excessive plant nutrients. Excessive amounts of plant nutrients (primarily phosphorus and nitrogen) cause excessive growth, or "blooms", of algae. Algae is aerobic, and consumes all the oxygen in a water ecosystem and can kill all other organisms in the water including fish.

Is one more important than the other? NO!!

Despite the fact than many agencies are only putting specification limits on phosphorus, the fact is that there must be a certain amount of nitrogen present as well. A lake with excessive amounts of phosphorus and no nitrogen will not undergo eutrophication.
Reducing Chloride Loading

What is the ‘Big Picture’?
Reducing Chloride Loading

Low Hanging Fruit

- Storage 5%
- Pre-Wet 30%
- Anti-Icing 4%
- Application Training 20%
Compare the costs with Caliber M2000 treated salt.

Traditional Dry Salt Application

- 60% Critical Area
  - 300 lbs. per lane mile
  - 180 lbs.
  - Application Rate
    - 60%
    - Critical Coverage
  - $25/ton
  - $0
  - Material Costs
    - Salt
    - Caliber M2000
    - Total Material Costs
    - 1 Ton of Finished Product
    - Covers xx miles??
    - Cost per lane mile
    - 6.667 miles
    - $3.75 per lane mile

Caliber M2000 Treated Salt Application

- 90% Critical Area
  - 200 lbs. per lane mile
  - 180 lbs.
  - Critical Application Rate
  - $25/ton
  - $10
  - Material Costs
    - Salt
    - Caliber M2000
    - Total Material Costs
    - 1 Ton of Finished Product
    - Covers xx miles??
    - Cost per lane mile
    - 10 miles
    - $3.50 per lane mile

Now factor in fuel costs, labor, maintenance, overtime, etc., and see how more cost effective pre-wetting is than traditional methods!!
Resources

- Center for Transportation Research and Education | [www.ctre.iastate.edu](http://www.ctre.iastate.edu)
- American Association of State Highway and Transportation Officials (AASHTO) | [www.aashto.org](http://www.aashto.org)
- Transportation Research Board | [www.nationalacademies.org/trb](http://www.nationalacademies.org/trb)
- Civil Engineering Research Foundation (CERF) (Highway Innovative Technology Evaluation Center, HITECH) | [www.cerf.org/hitec/index.htm](http://www.cerf.org/hitec/index.htm)
- Canadian Strategic Highway Research Program (C-SHRP) | [www.cshrp.org/english/](http://www.cshrp.org/english/)
- Salt Institute | [www.saltinstitute.org/2.html](http://www.saltinstitute.org/2.html)
- American Public Works Association (APWA) | [www.apwa.net/](http://www.apwa.net/)
- Ice and Snow Technologies | [www.iceandsnowtechnologies.com](http://www.iceandsnowtechnologies.com)
- Glacial Technologies | [www.anti-icers.com](http://www.anti-icers.com)
- Winter Maintenance email list service
- Very Good!

Email: snow-ice-request@list.uiowa.edu
www.coverall.net

www.shelterlogic.com

www.dome-corp-na.com

www.asicoverbuildings.com

www.bulkstorageinc.com

www.waltersbuildings.com
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### CALIBRATION CHART (US)

**Acres Group**

<table>
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<th>Control Setting</th>
<th>Shaft RPM (Loaded)</th>
<th>Discharge per Revolution (pounds)</th>
<th>Discharge per Minute (lb)</th>
<th>3 mph (x 20.00)</th>
<th>7 mph (x 8.57)</th>
<th>10 mph (x 6.00)</th>
<th>13 mph (x 4.61)</th>
<th>15 mph (x 4.00)</th>
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**THE ACTUAL APPLICATION RATE (POUNDS PER LANE MILE) ON THE HIGHWAY**

**IS THE DISCHARGE RATE DIVIDED BY THE NUMBER OF LANES BEING TREATED**