Advancements in Deicing Technology & Winter Maintenance to Help Keep Roads Safe

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Today's Agenda

- Understanding environmental impact
- Traditional products & methods
  - Salt, sand, timing, concerns
- Evolution of the industry
  - Liquid additives, pre-treated salts, salt brine
- High accident areas
- Role of technology
- Wrap up/Questions

Importance of Understanding Environmental Impact

- ALL activity has Environmental Impact
- Ecosystems are in constant flux
- “Doing Nothing” not necessarily best
- Goal – wisely balancing benefits and environmental impacts

Misuse of Deicing Chemicals Can Affect

- Soil
- Vegetation (particularly roadside)
- Ground water/wells
- Surface waters
- Aquatic life
- Corrosion

Soil Effects

- Highest Concentrations 6-10 feet from roadside
  - Elevated concentrations up to 33 feet from road, 3 feet deep)
- Na will ion exchange with Ca and Mg in soil
  - Decreased permeability
  - Decreased water availability to plants
  - Breakdown soil structure / increase erosion
- $CaCl_2$, $MgCl_2$, CMA may increase soil permeability / improve soil structure
- Acetate (CMA, KA) biodegrades to CO_2 – may lower soil pH
- Acetates may mobilize trace metals in soil

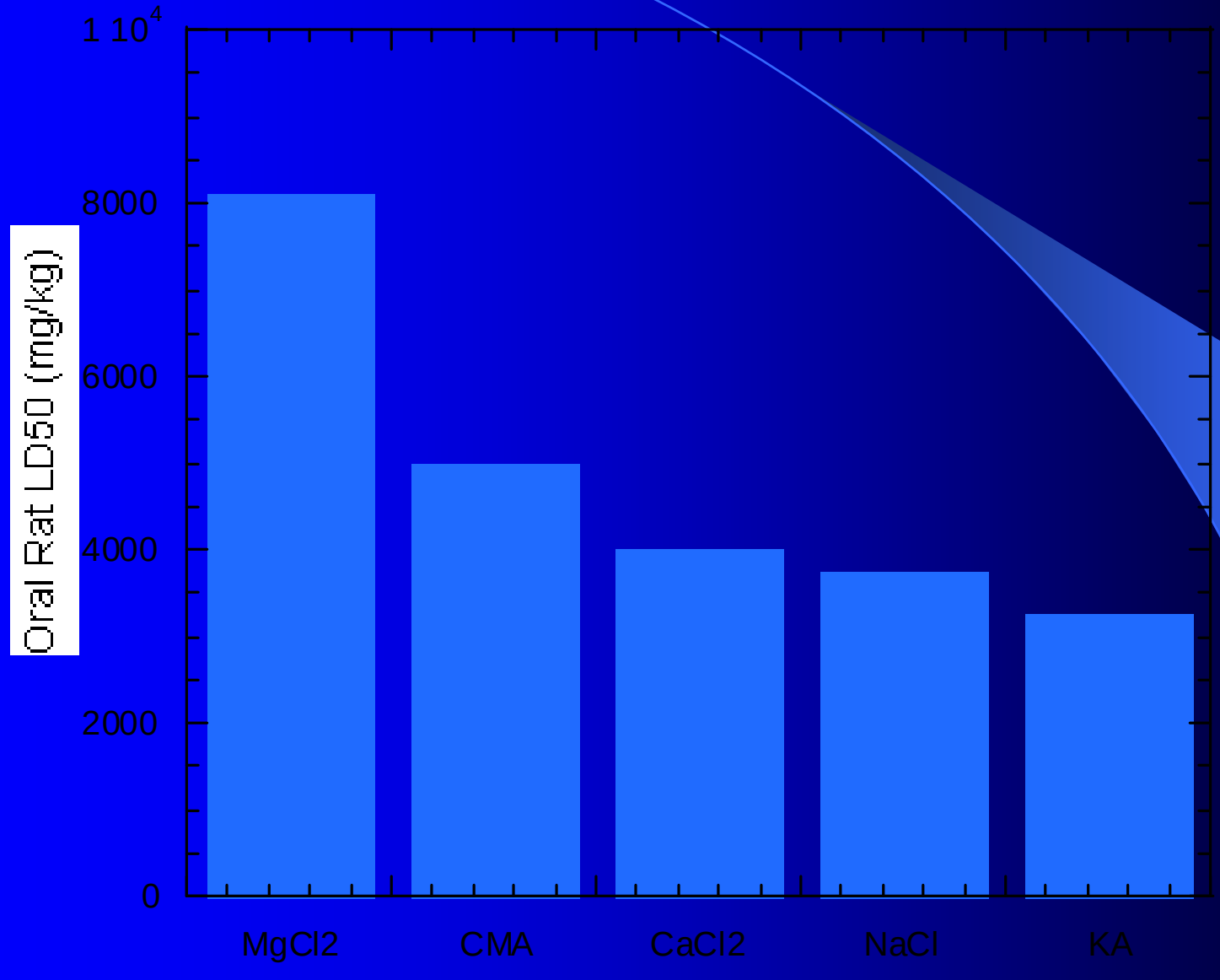
Effects on Vegetation

- Highest at roadsides
- Toxicity rankings vary
  - KA > CMA > $CaCl_2$ > NaCl > $MgCl_2$ (*Allium cepa* root elongation and Duckweed *Lemma* growth inhibition tests – Anneli, et. al. 2003)
  - NaCl ~ NaFo > CMA (germination and growth of cress and barley – Robidoux et. al. 2001)
- High chloride may be more damaging than high Na, thus $MgCl_2$ > $CaCl_2$ > NaCl (Hanes, 1976)
- CMA < NaCl on 17/18 of tree species studied (Winters et. al. 1985)
- Rankings appear to be dependent on the plant and environment

Effects on Surface/Ground Waters

- Increasing density in lower layers – inhibition of mixing/oxygen distribution
- Elevated chloride levels can inhibit plant growth and reduce organism diversity in streams.
- Organic additives and phosphorus additives may contribute to eutrophication
- Acetate deicers have high BOD

Acute Toxicities of Deicers
LD50 > 5000 = Practically Nontoxic



Aquatic Toxicity

Pesticide Toxicity Rating	LC50 (ppm)
Extremely Toxic	0.01 – 0.10
Moderately Toxic	1.0 – 10
Slightly Toxic	10 – 100
Minimally Toxic	> 100

- Common deicers typically LC50 > 500
- Commonly LC50 > 2000

Corrosion

- All chlorides will be aggressive to mild steel
- Acetates and formates non-corrosive to mild steel but very corrosive towards galvanized
- Corrosion inhibited deicers offer a middle ground option
- Corrosion protection of standard pre-wetted products is probably primarily on equipment

Traditional Products and Methods

- Salt
  - 22.2M tons purchased during 2008 for highway salt use in the U.S.*
  - Rock salt and solar salt are most commonly used on roads
  - NJ supplied mainly by International Salt, but also by Cargill, Atlantic, Eastern, and others
  - Almost limitless supply, however limitations do exist regarding salt production and storage
  - Used most commonly during and after winter storms

* Salt Institute website - www.saltinstitute.org

Traditional Products and Methods (cntd)

- Sand
  - Commonly used for improved traction
  - Often mixed with salt at various ratios to prevent stockpile freezing and to “cut costs”
  - Various suppliers and blends
  - Spread during and after storm

Concerns with Traditional Products

- Salt
  - Bounce & scatter
  - Effective temperature
  - Corrosion
  - Caking/clumping
  - Supply
  - Difficult to see against snow
- Sand
  - Cleanup (time)
  - Equipment rental
  - Disposal
  - Re-applications
  - Supply
  - Effect on catch basins
  - No melting benefits

Evolution of the Industry

- Liquid additives
  - Examples include calcium chloride, magnesium chloride, KA, CMA, and various proprietary blends
  - *Benefits* include: Reduced bounce and scatter, performance enhancement, and corrosion inhibition (amount varies depending on product)
  - *Drawbacks* include: Investment in liquid-related capital, training, equipment maintenance, over/under applying, time
  - Most commonly used at D.O.T. level
  - Applied to salt at the spinner, on the stockpile, or in the truck bed (overhead spray bar)

Pre-Treated Salts

- Were first introduced ~10 years ago
- Deicing salt you are currently using, treated with a blend of magnesium chloride and other “enhancements”
- These “enhancements” can help inhibit corrosion, enhance performance, increase the visibility of the product, and more
- Some examples include ClearLane™, Ice-Be-Gone™, Magic Salt™, etc.
- Most commonly used at the municipality level (where a liquid program is not feasible)

Pre-Treated Salts

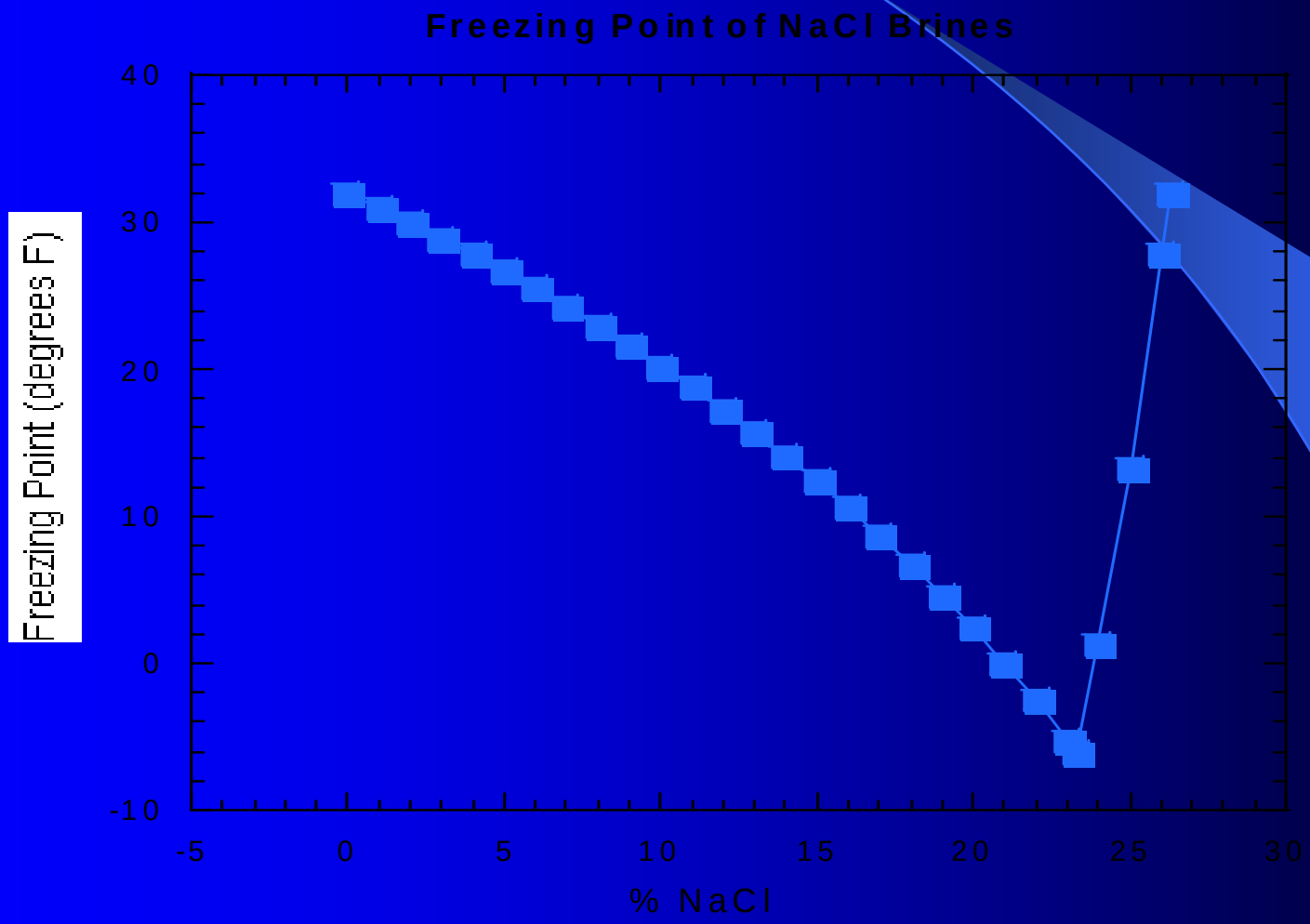
- Pro's
  - "All-in-one" product
  - Reduced scatter
  - Corrosion protection
  - Less product needed
  - Reduced cleanup when compared to salt/sand
  - Residual effect
- Con's
  - More expensive than salt (however….)
  - Requires adequate covered storage

Pre-Treated Salt (an example) - ClearLane™ enhanced deicer

Salt Brine…Another Liquid Option

- Difference between:
  - Pre-wetting
  - Anti-icing
  - De-icing
- Made with the salt you already have and water
- Things to consider:
  - Concentration
  - Automation vs Manual
  - Cleanout
- Upward flow versus downward flow models

Salt Brine Concentration



Product Savings – An Example

NaCl in Salt Brine

- Typical application rate is 30-50 gallons/lane mile
- At 23.3% concentration, there are 2.288 lbs of NaCl per gallon of brine
- At 50 gallons/lane mile x 2.288 lbs NaCl/gallon = 114.4 lbs NaCL/lane mile

NaCl as a De-Icer

- 300 lbs/lane mile?
- 400 lbs/lane mile?

- Salt brine:
  - Breaks the bond between the roadway and snow/ice
  - Reduces the amount of NaCl put out on your roads
  - Is a pro-active step (versus re-active)

Automation vs Manual

Clean Out

Example of a Downward-Flow Brinemaker

- Water flows in from above the salt
- Filters downward through the salt
- Brine collects at bottom, then gets sucked out

High-Accident Areas

- Bridges are commonly the first to freeze up during winter storms
- Maintaining safe bridges typically require extra manpower and extra product (chemicals)
- Two systems have emerged to address freezing conditions on bridges
  - F.A.S.T.
  - SafeLane®

F.A.S.T.

- Fixed Automatic Spray Technology
- Sprinkler head-like fixtures that are mounted into the bridge's driving surface or onto the guard rails
- Commonly linked to road sensors to determine if/when deicer is to be dispensed
- Manual or computer activated

SafeLane® Polymer Overlay HDX

SafeLane Surface

3/8” Thickness
4 lbs./ft^2

Existing substrate

SafeLane® Summary

SafeLane® surface overlay:

- Reduces the potential for winter accidents caused by ice and snow build-up on bridge and road surfaces
- Provides superior friction for year-round traction in all weather conditions
- Extends the life of bridge structures and reduces pavement maintenance
- Reduces lane closures by preventing weather-related accidents and installs quickly; can be installed in as little as one day

Role of Technology

- Industry continues to evolve by incorporating technology into winter operations
- Provides **objective** information instead of **subjective** information
- "Work smarter, not harder"
- Some examples include:
  - Traction testing
  - Road temperature sensors & RWIS
  - GPS mapping

Traction Testing

- Benefits include:
  - Continuously measure traction conditions over miles of road at a time
  - Maximize efficiency of plow routes
  - Gauge effectiveness of various products and application rates
  - Provide easily actionable feedback
  - Compatible with most GPS systems

Traction Testing – An Example
RT3™

RT3™


ROADWAY GRIP
HIGH
MEDIUM
LOW
DISPLAY BRIGHTNESS
SURFACE FRICTION
MENU
ON/OFF
ON/OFF
SYSTEM RESET
REMOTE DATA
Halliday Technologies
...from racetrack to roadway

Wrap Up

- There are many new options available to improve how you conduct winter operations
- These new advancements can provide value to you and your organization
  - Product savings, labor savings, environmental benefits, increased safety, road preservation, objective data, and more!

Thank you for your time!

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