Pollution Prevention for Snow & Ice Removal

November 2, 2021

TAG THIS PRESENTATION: @DOEE_DC
Salt in the District
Salt Pollution

While salt is naturally occurring, too much is destructive

Growing concern
- Harmful to children and pets
- Drinking water quality
- Health of rivers and streams
- Stress plants
- More complaints

Extremely difficult to remove once it’s in water
Two Types of Sewers

2/3 of the District’s land drains directly into local waterways with little to no treatment

- Municipal Separate Storm Sewer System (MS4)
- Combined Sewer System (CSS)
District Salt Priorities

- **Municipal Separate Storm Sewer System Permit (2018 MS4 Permit)**
  - Section 2.6 - District Salt Pilot
  - Section 3.3.8. - Snow and Ice Management
    - Manage application of ice-removal products to minimize their impact on water quality

- **Sustainable DC 2.0 Plan’s Actions on Water, WT1.3**
  - Study alternatives to reduce reliance on road salt by 2022
  - Work with Business Improvement Districts (BIDs), Main Streets, and large property owners
Current Efforts & Incentives

- Priority has been municipal roadway operations
- Commercial Property Workshops
- **DOEE Webpage:** go to [https://doee.dc.gov](https://doee.dc.gov) and search for “snow”
  - How to protect human health and the environment during winter
  - Salt Application Rate Calculator
- **Green Building Act of 2006**
  - Site Management (LEED O+M: Existing Buildings v4.1 - LEED v4.1)
What You Can Do
STRATEGIES

1. Alternative products
2. Techniques to minimize product use
3. Smart management and storage
1. **Alternative Chemicals***
   - Calcium magnesium acetate (CMA)
   - Magnesium Carbonate (Magnesium CA)
   - Alternative chlorides (MgCl)

2. **Traction** - sweep up after
   - Sand
   - Non-clumping kitty litter

3. **Snow Melting Mats**

*NOTE: These have different application rates than rock salt. Consult packaging*
LIQUID PRODUCTS

1. Hot mix and brine lasts 5-10 days
   - 23.3% salt = Good brine mix
   - Sustainable Alternatives: beet juice

2. Allows rock salt to melt ice below 15⁰ F

3. Melts ice faster

Photo courtesy of Wisconsin DOT transportation bulletin #22
MAKING & APPLYING BRINE

Making Brine:
- 23.3% solution, ~2.5 lbs salt/gal
- Use hot water
- Verify salinity with hydrometer or salometer

85% or 1.176

WesternPlows.com
Dejana.com
BugSpray.com

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2. TECHNIQUES TO MINIMIZE PRODUCT USE

1. Don’t apply when it’s above freezing or is expected to rain!
2. Apply beforehand
3. Use an application rate
4. Clear accumulated snow beforehand
5. Be patient - melting takes time
   • Apply a small amount first
   • Wait at least 30 minutes before applying more
6. Sweep up excess after the event

USE ENOUGH SO THE GROUND IS BARE BUT NOT SO MUCH THAT PRODUCT IS STILL VISIBLE
Salt application rates

- Not standardized
- Depends on ground temperature
- Depends on type and amount of precipitation

**Key:**
- SICOPS = University of Waterloo Study
- SSI = Sustainable Salt Initiative
- MN = Minnesota
- NH = New Hampshire
- SIMA = Snow and Ice Management Association

Sexton (2017)
## SALT APPLICATION RATES – NEW HAMPSHIRE

### NH Road Salt Application Rates for Deicing Parking Lots
(Pounds per 1000 sq.ft.)

<table>
<thead>
<tr>
<th>Pavement Temp. (°F) and Trend (↑↓)</th>
<th>Weather Condition</th>
<th>Maintenance Actions</th>
<th>Salt Prefert/ Pretreated with salt brine</th>
<th>Salt Pretert/ Pretreated with other blends</th>
<th>Dry salt</th>
<th>Winter sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;30 ↑</td>
<td>Snow</td>
<td>Plow, treat intersections only</td>
<td>4.5</td>
<td>4</td>
<td>4.5</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>5.75</td>
<td>5.25</td>
<td>6.5</td>
<td>Not recommended</td>
</tr>
<tr>
<td>30 ↓</td>
<td>Snow</td>
<td>Plow and apply chemical</td>
<td>5.75</td>
<td>5.25</td>
<td>6.5</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>6.5</td>
<td>5.75</td>
<td>7</td>
<td>Not recommended</td>
</tr>
<tr>
<td>25 - 30 ↑</td>
<td>Snow</td>
<td>Plow and apply chemical</td>
<td>5.75</td>
<td>5.25</td>
<td>6.5</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>6.5</td>
<td>5.75</td>
<td>7</td>
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<td>5.25</td>
<td>6.5</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>7</td>
<td>6.5</td>
<td>8.25</td>
<td>10.5</td>
</tr>
<tr>
<td>20 - 25 ↑</td>
<td>Snow or frz. Rain</td>
<td>Plow and Apply chemical</td>
<td>7</td>
<td>6.5</td>
<td>8.25</td>
<td>10.5 for frz. Rain</td>
</tr>
<tr>
<td>20 - 25 ↓</td>
<td>Snow</td>
<td>Plow and apply chemical</td>
<td>5.75</td>
<td>7.5</td>
<td>9.5</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>7</td>
<td>7.5</td>
<td>10</td>
<td>10.5</td>
</tr>
<tr>
<td>15 - 20 ↑</td>
<td>Snow</td>
<td>Plow and apply chemical</td>
<td>7.5</td>
<td>7.5</td>
<td>9.5</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>8.75</td>
<td>7.5</td>
<td>10</td>
<td>10.5</td>
</tr>
<tr>
<td>15 - 20 ↓</td>
<td>Snow or Frz. Rain</td>
<td>Plow and apply chemical</td>
<td>8.25</td>
<td>7.5</td>
<td>10</td>
<td>10.5 for frz. Rain</td>
</tr>
<tr>
<td>0 to 15 ↑</td>
<td>Snow</td>
<td>Plow, treat with blends, sand hazardous areas</td>
<td>Not recommended</td>
<td>10</td>
<td>Not recommended</td>
<td>13 and spot-treat as needed</td>
</tr>
<tr>
<td>&lt;0</td>
<td>Snow</td>
<td>Plow, treat with blends, sand hazardous areas</td>
<td>Not recommended</td>
<td>23</td>
<td>Not recommended</td>
<td>13 and spot-treat as needed</td>
</tr>
</tbody>
</table>

### Table 19. Application Rates for Deicing
NH 2014

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.
## SALT APPLICATION RATES - MINNESOTA

<table>
<thead>
<tr>
<th>Pavement Temperature</th>
<th>Application Rate</th>
<th>High-density Residential</th>
<th>Low-density Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>°F</td>
<td>Pounds per 1,000 ft²</td>
<td>Teaspoons per 8 x 10 ft sidewalk</td>
<td>Teaspoons per 6 x 10 ft sidewalk</td>
</tr>
<tr>
<td>Above freezing (&gt;32 °F)</td>
<td>Do not apply salt. Ice will not form.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-32 °F</td>
<td>0.75</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>25-30 °F</td>
<td>1.5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>20-25 °F</td>
<td>2.25</td>
<td>7.5</td>
<td>5.75</td>
</tr>
<tr>
<td>15-20 °F</td>
<td>2.75</td>
<td>9.25</td>
<td>7</td>
</tr>
<tr>
<td>Below 15 °F</td>
<td>Salt does not melt ice below 15 °F without adding heat or an additional chemical to assist with melting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum rate</td>
<td>3</td>
<td>10 (≈¼ cup)</td>
<td>7.5 (≈⅛ cup)</td>
</tr>
</tbody>
</table>

When to adjust:
1. Salt is on the ground from the last event
2. Falling temperatures
3. Freezing rain
4. Heavy snowfall

Rates are based on Ground Temperature

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*Based on Minnesota’s Application Rate Table for Sidewalks and Parking Lots (2015).*
Applications rates make a big difference

GOOD

BAD

AHHHHHHH
SPREADERS

Typical Spreaders

DIY Spreader
CALIBRATION OF SPREADERS

Tells how much is applied at each setting

- Auger / Conveyor system
  - Choose a setting, run the spreader for a timed interval, weigh the discharge

<table>
<thead>
<tr>
<th>SETTING</th>
<th>POUNDS PER MINUTE</th>
<th>5 MPH (x12)</th>
<th>10 MPH (x6)</th>
<th>15 MPH (x4)</th>
<th>20 MPH (x3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Figure 10: Blank calibration form
CALIBRATION OF GRAVITY FED SPREADERS

- Gravity fed
  - Mark out 10-ft stretch, apply at constant speed, sweep up, and weigh
  - Use a tarp to make weighing easy
  - Make permanent marks on the equipment if it has no numbers for the positions

### Calculate application rate:

<table>
<thead>
<tr>
<th>Equipment:</th>
<th>Material:</th>
<th>Date:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Lever position or gate setting</td>
<td>Pounds spread in 10 feet*</td>
<td>Spread width in feet</td>
<td>Coverage area in sq. ft. (D x 10)*</td>
<td>Application rate in lbs./1000 ft² (1000/E x C)</td>
<td>Application rate in lbs./lane mile (12’ width) (F x 63.4)</td>
</tr>
</tbody>
</table>

**Example**

| 20 MPH | Half-closed | 0.4 lbs. | 13 feet | 130 sq. ft. | 3.1 lbs. per 1000 sq. ft. | 196 lbs./mile |

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*If changing the test strip length, adjust the title in column C and the multiplier in column E.*

Figure 14: Example calibration chart for gravity flow equipment
3. PREVENT AND CLEANUP SALT SPILLS

- Never overfill equipment
- Clean up spills ASAP
  - Sweep up excess and use at a later date/throw out or
  - Sweep it to an area that hasn’t been treated yet
STORAGE

Prevent contact with stormwater

• Keep it inside

• If outside:
  o Elevate and use waterproof cover
  o Locate pile where no stormwater can run underneath

This pile is placed on the uphill edge of a curbed parking lot where no runoff can leach salt from under the pile
SUMMARY OF WHAT YOU CAN DO

There are many things you can do to minimize salt pollution this winter:

1. Use alternative products
2. Be smart with your application technique to minimize how much is used
3. Store salt in a place that is protected from rain and sweep up excess
District Ice Management Survey
Salt Management Survey

Goal: Identify a strategy to encourage commercial properties and places of worship to switch to environmentally-safe alternatives to road salt for managing icy sidewalks, parking lots, and driveways

- Identify current trends and opinions
- Investigate opportunities and barriers to switch to environmentally-friendly alternatives
- Share findings with ice removal operations at District-owned properties
Target Audiences

• Commercial Properties
  o Includes shops, office buildings, apartment buildings, condos, and mixed use
  o 6.28% of District land is high density residential, mixed use, and commercial
  o 11 established Business Improvement Districts (BIDs)
    ▪ Over 130 miles of sidewalk maintained
  o 26 Main Streets in the District
    ▪ 84.9 miles of streets ≈ 160 miles sidewalk

• Places of Worship
  o Churches, Mosques, Synagogue, Temples, et al.
  o 775 Places of Worship in 749 locations in the District
Methodology – Online Survey

• 10-minute anonymous online survey with 15 questions

• Four Main Sections
  1. Type of organization
  2. Current ice management practices, with deep dive into product application
  3. Satisfaction with current strategy
  4. Encouraging a switch - motivations and resources

• Data Collection
  1. Online Survey: email followed by phone calls
  2. Direct Outreach
     a. Target audience: follow up questions by phone
     b. Snow and Ice removal contractors: market research by phone
Ice Management Survey

In the District of Columbia when salt that is applied to sidewalks and roadways to melt ice, most of it is eventually is flushed out into our streams and rivers. District waterways are fresh water, so this influx of salty water harms the animals and plants that call our streams and rivers home. With more people using salt on their sidewalks, driveways, and parking lots to manage ice than in the past, the environmental impacts of salt in the District are becoming more intense. There is a growing concern over the use of salt to manage ice in the winter months in the District of Columbia and surrounding region as we see increasing impacts to our waterways and to our drinking water, which comes from the Potomac River.

The Department of Energy and Environment (DOEE) is asking you to fill out this short, 10-minute survey. The survey will help the District better understand what strategies are currently being used by commercial buildings and places of worship to manage ice and how to best encourage a voluntary shift to more environmentally-friendly practices.

For additional information about these efforts, please contact DOEE’s Stormwater Pollution Prevention Team at DOE_P2@dc.gov or call 202-281-7174.
# Online Survey Responses

Duration: 3 months, March 15\textsuperscript{th} - May 15\textsuperscript{th} 2021

<table>
<thead>
<tr>
<th>Type</th>
<th># Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Property</td>
<td>13</td>
</tr>
<tr>
<td>Multi-Family Units*</td>
<td>2</td>
</tr>
<tr>
<td>Commercial Property</td>
<td>9</td>
</tr>
<tr>
<td>BID/Main Street</td>
<td>2</td>
</tr>
<tr>
<td>Places of Worship</td>
<td>19</td>
</tr>
<tr>
<td>Churches</td>
<td>9</td>
</tr>
<tr>
<td>Synagogue</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>9</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>

*Apartment buildings and condos*
Survey: Current Trends

- **87.5%** apply products that melt ice
- No one uses traction or snow melting mats
- **Who applies the product**
  - Places of Worship: 50/50 Contractors and Staff
  - Commercial Properties: Staff
- Everyone is satisfied with their methods

### Strategy Table

<table>
<thead>
<tr>
<th>Strategy</th>
<th># Responses</th>
<th>Satisfaction*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deicer, like salt or salt-alternative</td>
<td>28</td>
<td>8.2</td>
</tr>
<tr>
<td>Traction, like sand or sawdust</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Snow melting mats or other heating methods</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Physically Remove</td>
<td>2</td>
<td>8.5</td>
</tr>
<tr>
<td>Other: both physically remove and use deicer</td>
<td>2</td>
<td>9.0</td>
</tr>
</tbody>
</table>

* On a scale of 1 being least satisfied and 10 being the most satisfied

### Who Applies the Product?

- **Staff**
- **Contractors**
- **Tenants**
- **Volunteer**

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Survey: Product Type

1. Chloride-base alternatives are the most popular
2. Commercial Properties are more likely to use chloride-free alternatives
3. Places of Worship are most likely to use rock salt
4. Few places use liquids and they are only being used on driveways and parking lots
1. Both audiences apply product before, during, and after the event
2. Commercial properties are already cleaning up leftover product
3. Places of worship are willing to start cleaning up product
Survey: Tracking

1. Sidewalks are the most common type of infrastructure to be treated
   - Commercial properties didn't report treating as many driveways and parking lots as places of worship
2. Places of worship least likely to track how much they use
3. Most popular method of tracking is total amount used for the season
4. Places of worship are most likely to calibrate their equipment, but nobody reported following an application rate

**Places of Worship**

- Not tracked
- Total amount used during the season
- Amount used for each event
- Calibrate spreaders/equipment
- Use an application rate

**Commercial Properties**

- Sidewalk
- Driveway
- Parking Lot
1. Places of worship are less aware of the environmental impacts of salt. They are most concerned about drinking water and damage to plants.

2. Commercial properties are concerned with salt’s impact to infrastructure, plants, and drinking water.
Survey: Encouraging a Switch

1. Minimize additional costs through rebates, incentives, etc.
2. Provide a list of products, contractors, and resources
3. Places of worship interested in testimonials
4. Commercial properties interested to know more about LEED certification and instructions
5. Few interested in workshops, online resources instead

![Bar Chart]

- List of products, contractors, and other resources
- Rebates/incentives
- LEED Certification Points
- Online Resources
- Workshops
- Other

- Places of Worship
- Commercial Properties
Contractor Outreach Results

Few were willing or had time to talk

- Confirmed landscaping businesses provide snow and ice removal

- **Current market**
  - Only one said customers specifically asked for environmentally-friendly products

- **Environmentally-friendly services**
  - Most would not discuss costs over the phone
  - Most only use one product
  - Only one business provides options for deicers
Conclusions

• Overall
  o Many have already switched to chloride-based alternatives
  o Interested in alternatives, but costs are a concern
  o Rebates or incentives could help address these concerns

• Places of Worship
  o As non-profits they have tight budgets
  o More likely to use rock salt and use contractors
  o Willing to learn about and make changes, e.g. cleaning up leftover product
  o Slightly less happy with their current methods

• Commercial Properties
  o Ahead of the curve with adopting alternative products, and already clean up leftover product
  o Concerned with impacts to infrastructure
  o Appear to be happy with and proud about current practices
Take Home Messages

- The most cost-saving technique was not being used - application rates
- Those that used alternatives to rock salt were more satisfied
- If you use a contractor, ask them to use an alternative
- It’s easy to sweep up deicers left after an event
What would encourage you to adopt alternatives?

Clara Elias
Partnering and Environmental Conservation Branch
Watershed Protection Division
clara.elias@dc.gov
202-645-4231
doee.dc.gov
Resources:


**Salt Institute.** Various resources on salt application and storage. *Note: industry funded.* [http://saltinstitute.org/road/snowfighting/](http://saltinstitute.org/road/snowfighting/)

