

**Proponent Testimony
For
Senate Bill 165
From
Dave Mansbery
Before the
Senate Energy & Natural Resources Committee
On
Wednesday, October 18, 2017**

Chairman Balderson, Vice Chair Jordan, Ranking Minority Member O'Brien and members of the Senate Energy & Natural Resources Committee thank you for the opportunity to provide proponent testimony today on SB 165. My name is Dave Mansbery and I'm the owner of Duck Creek Energy, Inc. and Nature's Own Source, LLC which processes raw brine into a new finished product called *AquaSalina*.

What are we asking?

I'm here today to discuss with you a change to Ohio law that encourages processing and reuse of the water byproduct of conventional, vertical production wells (also known as raw "brine"). I have samples of each so you can see for your very own eyes the difference (or see attached pictures). Under current Ohio law, state and local governments are exempt from storage and application of this oily, dirty salt water – but not the private sector. I'm not here to ask for the same type of exemption. My ask is that once a company goes through the time and expense to process raw brine into a finished product or commodity that is not expected to result in damage or injury to public health, safety or the environment ODNR's job is complete.

Duck Creek Energy and Nature's Own have been producing *AquaSalina* at its Cleveland facility since ODNR provided a Chief's Order in 2004. I along with my team began selling this product to local governments, universities, churches, schools, retailers and other small businesses as an alternative to simply dumping salt or raw brine to help keep roads, sidewalks and other surfaces safe when temps get as low as -15 degrees.

We have been working with ODNR on a solution, but have come to a crossroads. ODNR's position is that the Ohio General Assembly changed ORC 1509.22 in the 130th budget bill, HB 59, which adds regulatory burdens on my company and any private sector company or individual hauling and using AquaSalina. ODNR's position is that even after we have processed raw brine anyone using our product must register as a UIC hauler, pay the \$50 fee, as well as track and report back to ODNR where they use our product. That includes anyone who decides to go purchase a 2-gallon container of my product at Lowe's in Northeast Ohio. My question is why? This places my product at a competitive disadvantage when someone can buy a bag of salt or a product that contains the same chemical composition without government fees or reporting obligation. In this case, government overregulation seems to be an understatement.

Since this General Assembly and several before it have been more inclined to enact common sense laws and regulations I will agree to disagree with ODNR's interpretation and hope you will do the same by supporting this law change.

What makes AquaSalina better?

What's the secret? Man-made brine can deice at temperatures between 20-25 degrees Fahrenheit and rock salt is only effective to 6 degrees. But, *AquaSalina* is 400 million year old ancient sea water. It can deice to -15 degrees. It also eliminates the need for public and private entities to fowl fresh water to make brine for road treatments by combining salt and treated water used from public sources. Independent studies provide proof that using liquids, like AquaSalina, in conjunction with salt reduces rock salt consumption by up to 30 percent putting less chlorides into lakes and rivers. In addition, while state and local

governments are permitted under current law to dump raw brine for deicing and dust suppression at up to 3,000 gallons per lane mile you only need to use 30-50 gallons of *AquaSalina* for deicing the same distance. In all circumstance *AquaSalina* is absolutely the most environmentally friendly out of all surface application options.

Third Party Validation

I knew we were doing a good thing, but I wanted third party validation of our product. So, we focused on additional national and state certification for *AquaSalina* and educating the public on the product. The product has been thoroughly studied by the Temple University for Pennsylvania DOT, as well as the University of Akron study for our own ODOT and Montana State University for Ohio DOT, which include chemical, environmental and ice melting capacity. AquaSalina and AquaSalina products always comes out #1 as a top rated product when looking at these three factors.

As the reputation of *AquaSalina* has grown Duck Creek Energy and Nature's Own has experienced steady growth over the last decade. I expanded operations in 2015 by opening up the Mogadore facility to handle the volume of demand. A big reason for the expansion was the addition of two clients that are important to all of us and our families – the Ohio Department of Transportation (10 of the 12 districts) and the Ohio Turnpike Commission. Any of you in ODOT District 10 and 11 please see us afterward. (see attached map with ODOT, Turnpike and pinpoint location of all AquaSalina customers across the state).

ODOT and Turnpike officials did their due diligence before buying AquaSalina. One criteria was becoming an approved and a qualified product listing of the Pacific Northwest Snowfighters (PNS) and the Clear Roads Organization, which is made up of 34 state Department of Transportation. Ohio DOT is a member. In order to sell to product in Ohio this PNSA certification is required. So I did it.

The capacity to do more

In 2013-14 Duck Creek processed 764,000 gallons of raw brine. In 2014-15, due to the colder winter, it processed 2.4 million gallons. And in 2015-16, Duck Creek processed roughly 2 million gallons. That means for every gallon of raw brine produced into AquaSalina that saves one more gallon of fresh water from being fouled with salt and one more gallon not being injected into a well. Duck Creek's two facilities can process 6,000 gallons an hour each and if operated 24 hours per day they could process 280,000 gallons a day or over 100 million gallons a year.

Conclusion

Mr. Chairman and members of the committee we should be promoting small businesses like Duck Creek Energy and the innovative solutions to problems every chance we get. We don't know of anyone else in this predicament. I'm just a small business owner that figured out how to take the dirty, oily raw brine water from vertical well production (at no cost to the supplier) and process it to make a useful product rather than paying to have it dumped into a Class II injection well. That is a good thing by itself. But, I along with my team go a step further. We recycle the oil, filter the remaining water and turn it into a product to keep Ohioans safer when used by ODOT, Ohio Turnpike, local governments, universities, churches, schools, retailers and other small businesses as an alternative to simply dumping salt, raw brine or fouling fresh water with salt to make man-made brine. I hope you will agree that SB 165 is good public policy and the state should encourage more companies to find useful ways to use such byproducts rather than making it more difficult to do business in Ohio.

Thank you for your time and attention. I want to thank Sen. Dolan and Sen. Skindell for introducing SB 165. I, along with my legislative counsel, Tony Fiore from Kegler Brown Hill + Ritter, would be happy to answer any questions.

Since 2004, the Ohio Department of Natural Resources has found that AquaSalina™ is a commodity and not subject to the same brine regulations as “raw brine”

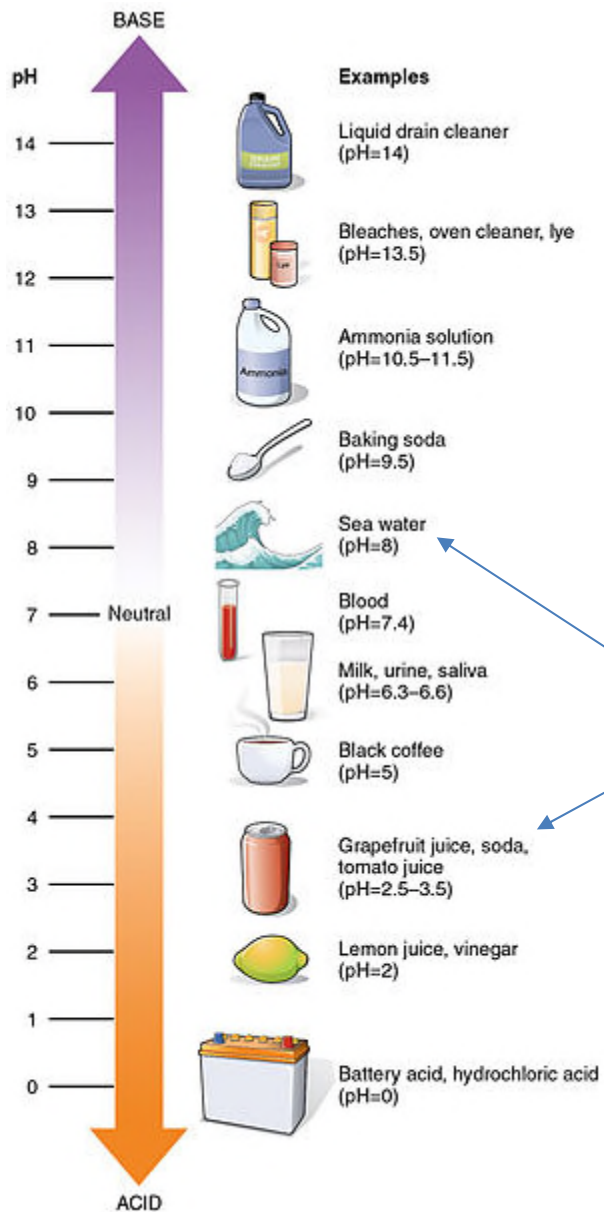
Transcribed from 2004-82 Order by the Chief of ODNR titled “APPROVAL OF A NEW METHOD OF BRINE DISPOSAL” dated October 22, 2004 (renewed annually through 2016) – see attached

- “Unlike untreated produced brine, AquaSalina™ is a commodity, not a waste product for which users of AquaSalina™ will be charged a fee. The recommended spreading rate for AquaSalina™ is less than the maximum allowable spreading rate currently allowed by Section 1509.226(B)(5) of the Ohio Revised Code for raw brine. When spread at the recommended-rate, AquaSalina™ will not cause, or cannot reasonably be anticipated to cause water consumed by humans or domestic animals to exceed the standards of the Safe Drinking Water Act or result in damage or injury to public health, safety or the environment.”
- “Pursuant to Section 1509.22(C)(1) of the Ohio Revised Code (O.R.C.), the Division of Mineral Resources Management hereby conditionally approves the use of AquaSalina™ as a new technology for disposal of brine for de-icing road surfaces, or dust control, use in port-a-john restrooms, or other product applications so approved by the Division from time to time. Surface application of AquaSalina™ is exempt from compliance with Section 1509.226(A-F, H and I) of the O.R.C.”
- “AquaSalina™ will only be transported and spread from Duck Creek Energy, Inc.’s processing facility with vehicles that are exempt under O.R.C. 1509.226(G) and that are not used for transportation of oilfield brine or other chemicals or substances that may be hazardous to public health or safety or by other dedicated vehicles that are not used for transportation of oilfield brine or other chemicals or substances that may be hazardous to public health or safety. Pursuant to 1509.226(G) because the disposal of AquaSalina™ under this Order is a new technology, such dedicated vehicles are exempt from the registration, disposal plan and surety bond requirements under 1509.222, 223 and 225 of the Ohio Revised Code.”

ODNR Confirmation Letter from Tom Tomastik dated February 10, 2011 – see attached

- “Pursuant to Section 1509.22(C)(1) of the Ohio Revised Code, the Division of Mineral Resources Management (Division) hereby conditionally approves the use of AquaSalina™ as a new technology for disposal of brine for de-icing road surfaces, or dust control, use in port-a-john restrooms, or other product applications so approved by the Division from time to time. Surface application of AquaSalina™ is exempt from compliance with Section 1509.226(A-F, H and I) of the Ohio Revised Code.”
- “This exemption means that AquaSalina™ can be applied to road surfaces without obtaining a resolution from the county and does not have to adhere to the nine guidelines required of the spreading of untreated oilfield brine under Section 1509.226(B) of the Ohio Revised Code.”

AquaSalina™ is between grapefruit juice and sea water as it relates to acidity



AquaSalina is **not produced for human consumption**, but here are some fun facts:

By way of comparison,

- Skittles, gummy bears and some more sour candy have pH levels of 1.6 to 3.5.
- Gatorade and Powerade have pH levels of between 2.67 to 2.99.



Between 3.78 – 8.0%

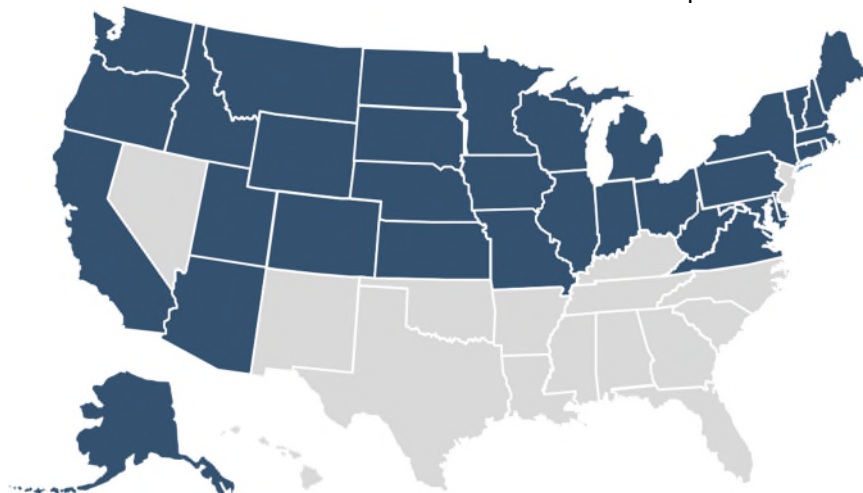
- ODNR's current approach indicates that it will NEVER approve a process that treats brine to a non-regulated level. But this is an overarching objective of the industry – to create a product that will eliminate or minimize injection well disposal. ODNR agreed from 2004 until 2016 that was the right approach.
- In light of the cost to treat brine to produce AquaSalina™, ODNR's continued regulation simply encourages the use of raw brine on the roads at in far higher quantities. If I can get it for free, I'm not going to pay extra for AquaSalina™.
- Class II Injection wells are the main disposal option for brine – vertical and horizontal. The public is very adverse to the risk of injection wells and any means to reduce Ohio's reliance on these wells is a benefit. Also preserves fresh water.

ODOT due diligence before utilizing **AquaSalina™** in 10 of 12 Districts as well as the Ohio Turnpike to keep Ohio roads safer during bad weather.

AquaSalina™ went through 13 months of review before becoming a Qualified Product through the Clear Roads Group and the Pacific Northwest Snowfighters.



<u>Clear Roads Group</u>	<u>Pacific Northwest Snowfighters (PNS)</u>
<p>Clear Roads is a national research consortium focused on rigorous testing of winter maintenance materials, equipment and methods for use by highway maintenance crews.</p> <p>Since getting under way in 2004, Clear Roads has grown to include 34 member agencies, each contributing \$25,000 annually to fund research and technology transfer efforts. Representatives from the participating departments of transportation meet twice a year to discuss and prioritize projects, share effective practices, and review research results.</p> <p>Primary Activities:</p> <ul style="list-style-type: none">• Evaluating winter maintenance materials, equipment and methods under real-world conditions.• Developing specifications and recommendations.• Studying and promoting innovative techniques and technologies that will save agencies money, improve safety and increase efficiency.• Supporting technology transfer by developing practical field guides and training curriculum to promote the results of research projects. <p>Click here to learn more about the Clear Roads Group.</p>	<p>Clear Roads partners with the Pacific Northwest Snowfighters (PNS) to coordinate materials testing and standards for deicing chemicals by supporting the maintenance of their Qualified Product List (QPL).</p> <p>PNS is an association of transportation agencies dedicated to ensuring the safety of winter maintenance products through structured testing and evaluation. The group established procedures for testing deicing and anti-icing chemicals and maintains specifications that these products must meet to be considered for widespread use. PNS has become a nationally recognized leader in establishing and standardizing chemical products for snow and ice control.</p> <p>The specifications developed by PNS help guide transportation agencies around the country in the selection of chemical products for winter maintenance applications. Products selected for inclusion on the PNS QPL must meet the following criteria:</p> <ul style="list-style-type: none">• Pass a series of tests for friction, corrosion, and chemical and toxicological properties• Meet environmental and health standards. <p>Click here to learn more about PNS.</p>

Member states of the Clear Roads Group

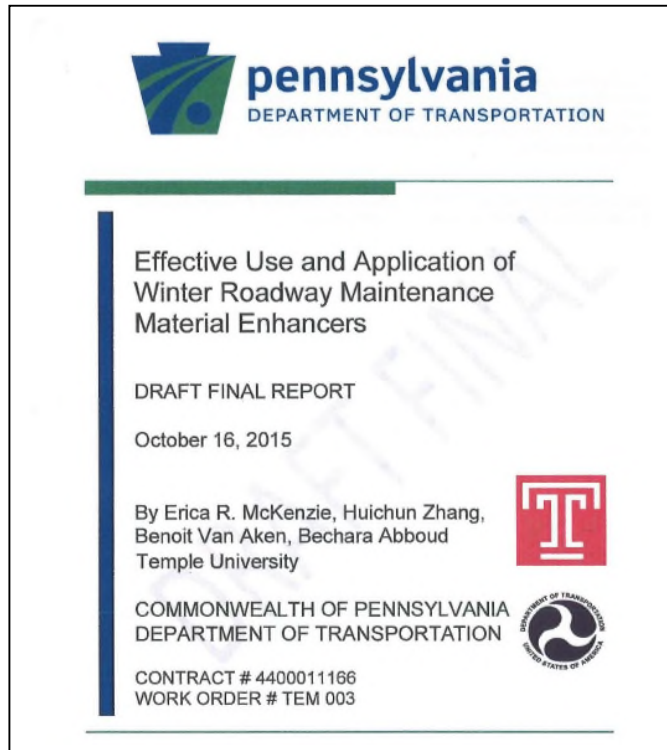


Three independent studies were conducted for Ohio and Pennsylvania

Study conducted by Montana State University (Western Transportation Institute) for Ohio Department of Transportation (ODOT) – December 28, 2013

<div>Evaluation and Analysis of Liquid Deicers for Winter Highway Maintenance Operations</div> <div></div> <div><div>Prepared by: Xianming Shi, Michelle Akin, Jiang Huang, Yan Zhang, Scott Jungwirth, Yida Fang, Anburaj Muthumani, Ping Yi</div><div>Prepared for: Western Transportation Institute Montana State University Bozeman, MT</div><div>December 28, 2013</div><div>Final Report</div></div> <div></div>	<div><ul style="list-style-type: none">• “Study conducted to compare liquid deicers that work best in Ohio.”• “The products must rank high in cost-effectiveness, minimal environmental impact, low corrosiveness, melting capacity, material compatibility, and availability.”• “Compared with traditional methods for snow and ice control, anti-icing leads to (1) decreased applications of chemicals and abrasives, (2) decreased maintenance costs, (3) improved level of service, and (4) lower accident rates.”• Idaho case study – years of anti-icing with liquid MgCl₂ on U.S. Highway 12: 1) reduced accidents by 83 percent; 2) abrasive use by 83 percent, and 3) labor hours by 62 percent.• Minnesota DOT – used a mixture of MgCl₂ and brine for anti-icing resulting in: 1) reduction of accidents, 2) rapid bare lane regain times, and 3) less deicer usage.</div>	
<div><div>For relatively high traffic volume roads under light snowfall</div><div><ul style="list-style-type: none">○ Pavement temperature 15°F -20°F:<ul style="list-style-type: none">▪ Anti-ice using salt brine at 20-30 gln/l-mi or Product C at 40-60 gln/l-mi; or Anti-ice using Product A (AquaSalina™) at 30-50 gln/l-mi if less plowing is planned.▪ De-ice using salt brine at 30-60 gln/l-mi or AquaSalina™ at 20 gln/l-mi; or De-ice using AquaSalina™ at 35-70 gln/l-mi if less plowing is planned.○ Pavement temperature 25°F – 30°F:<ul style="list-style-type: none">▪ Anti-icing using salt brine at 20-40 gln/l-mi or AquaSalina™ at 23-46 gln/l-mi;<div>De-ice using salt brine or B20-SB80 at 20-30 gln/l-mi.</div></div></div>	<div><div>For low traffic volume roads under light snowfall:</div><div><ul style="list-style-type: none">○ Pavement temperature 15°F - 20°F:<ul style="list-style-type: none">▪ Anti-ice using AquaSalina™ at 30-50 gln/l-mi;▪ De-ice using AquaSalina™ at 35-70 gln/l-mi;○ Pavement temperature 25°F – 30°F:<ul style="list-style-type: none">▪ Anti-icing using I25-SB75 at 20-30 gln/l-mi;▪ De-ice using salt brine at 20-30 gln/l-mi.</div></div>	<div><div>For relatively high traffic volume roads under heavy snowfall –</div><div><ul style="list-style-type: none">○ Pavement temperature 15°F - 20°F:<ul style="list-style-type: none">▪ Plow frequently while giving sufficient time for deicer to work after its application;▪ De-ice using AquaSalina™ at 70 gln/l-mi or salt-brine-pretreated-salt at 16 gal/ton and 400 to 650 lb/l-mi.○ Pavement temperature 25°F – 30°F:<ul style="list-style-type: none">▪ Plow frequently while giving sufficient time for deicer to work after its application;▪ De-ice using Product-C-pretreated-salt at 8 gal/ton and 250 to 350 lb/l-mi.</div></div>

Study conducted by Temple University for the Pennsylvania Department of Transportation (Penn DOT) – October 16, 2015



- “A study was conducted to evaluate the product performance and potential environmental effects of five (5) winter maintenance additives: salt – reference (as brine or rock salt), **AquaSalina™**, BEET HEET, Green Blast, and Magic Minus Zero.”


- “The top three performers, based on product performance, were as follows: 1) **AquaSalina™**, 2) GreenBlast, 3) Magic Minus Zero.”

- “Freezing point testing of all deicers solutions indicates that the two liquid deicers, **AquaSalina™** and GreenBlast, have lower freezing points than salt brine of the same concentration, and thus, will have better anti-icing ability than salt brine, while BEET HEET and Magic Minus Zero were similar to rock salt.”

- “When evaluating the performance of all deicers based on both deicing and anti-icing, AquaSalina always has the best performance and BEET HEET always has the worst performance”
- “In general, it can be said that *direct* environmental effects (water quality and toxicity) associated with the five tested deicers are expected to be minimal”
- “In Scenario 1 when deicing and anti-freezing are equally weighted, the ranking of the deicers is AquaSalina = GreenBlast > Magic Minus Zero > rock salt = salt brine > BEET HEET.”
- “In Scenario 2 when deicing is more valued, the ranking of deicers is AquaSalina > Magic Minus Zero > GreenBlast = rock salt = salt brine > BEET HEET.”
- “In Scenario 3 when anti-icing is more valued, the ranking of the deicers is AquaSalina > GreenBlast > Magic Minus Zero > rock salt = salt brine > BEET HEET.”

Study Conducted by University of Akron for the Ohio Department of Transportation – September 1, 2017


Evaluation and Analysis of Liquid Deicers for Winter Maintenance



Prepared by:
William H. Schneider
Teresa J. Cutright
Mallory J. Crow
Andrew Pelfrey

Prepared for:
The Ohio Department of Transportation,
Office of Statewide Planning & Research

State Job Number: 134933
September 1, 2017
Report

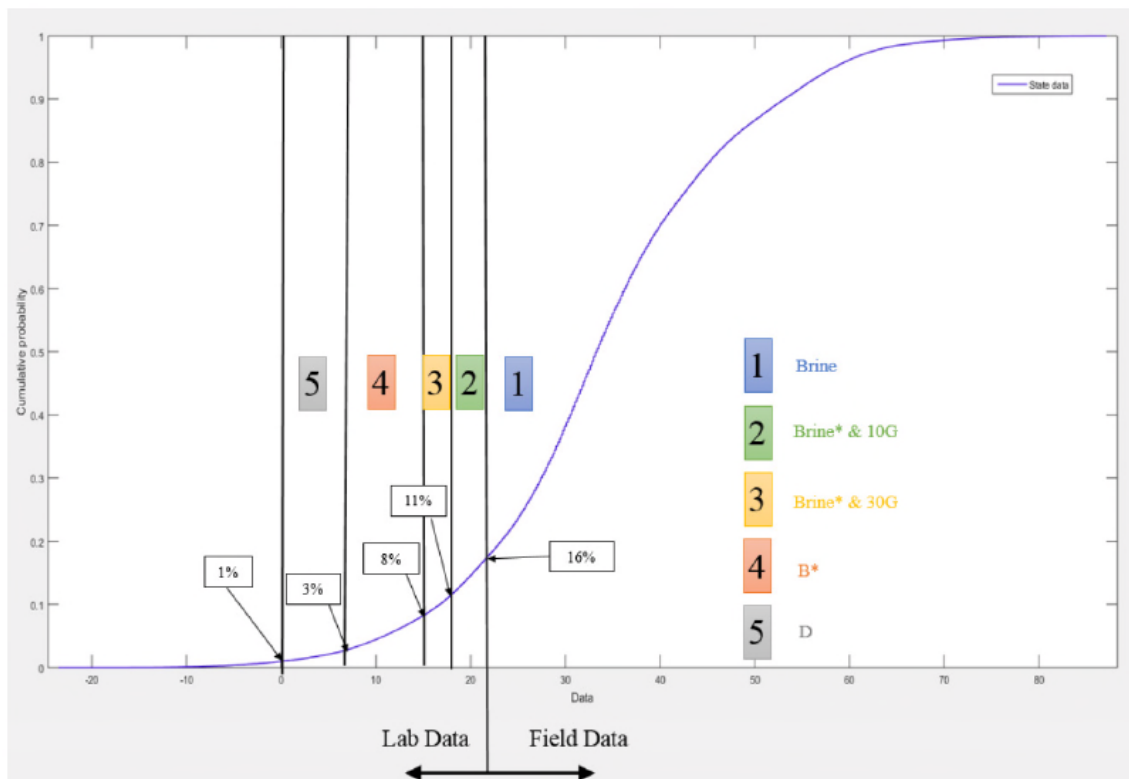


Deicer Key

- **Deicer A – AquaSalina (AQ)**
- Deicer B – XO Melt 2
- Deicer C – BeetHeat Severe
- **Deicer D – AQ + Icebyte**
- Deicer E – IceBan 305
- Deicer F – BeetHeat Concentrate
- Deicer G – Themapoint 793
- Deicer H – Cryotech CF7
- Control - Brine

Based on performance and then cost, brine is recommended for temperatures $\geq 21^{\circ}\text{F}$. Brine performed fair (not good) from 15°F to 21°F . **Deicer D** is the best for temperatures between 0°F to 7.5°F . Note See Figure 5 and 6 below for more details.

Figure 6: Recommended Based on Lowest Cost per Gallon from Deicer



The Ohio Department of Transportation (ODOT) is responsible for constructing and maintaining Ohio's most valuable man-made asset, the transportation network. Ohio has 21 interstates which is the 5th most of any state, is the 5th in total vehicle miles traveled, and is a single day's drive from 60% of the nation's population (ODOT Annual Report, 2016). Therefore, keeping these roadways clear during snow and ice events is essential for public safety as well as the national economy. In order to obtain clear roadways, ODOT spent approximately \$86 million annually on labor, equipment, and materials (ODOT, 2013).

The snow and ice that may accumulate on the roadways form a layer between the tires and road surface, which results in decreased traction. There are two primary methods for snow and ice control, mechanical removal and chemical removal. Mechanical removal consists of using snow plows to push the snow off the roadways, and is not the focus of this research. Chemical removal is done by adding certain chemicals, such as calcium chloride, which will react with the snow and ice to melt the snow, and then the liquid will easily run-off the road. Chemical removal may be done with solid, rock salt or liquid deicers or anti-icing chemicals.

Liquid deicers are used as effective techniques of snow and ice control. They make the plowing of snow and ice accumulation efficient. Plowing is more difficult when the snow or ice adheres to the pavement forming a bond (Penn and Meyerson, 1992). Bonding of the snow and ice to the pavement causes a decrease in traction between the tires of the passing vehicles and the road itself. Deicing is the act of breaking the bond once it has formed. Anti-icing, the newer of the two processes, is used to prevent the bond from occurring. These two techniques are widely favored in the snow and ice control industry. Though these liquids may be used for either techniques. These chemicals will be referred to as deicers in this report. In recent years, winter maintenance crews are testing various types of liquid deicers to assist in snow and ice control. These deicing liquids help prevent or remove the accumulation of the snow or ice when applied to roadways. Deicers help ensure sufficient traction of tires on the road to keep drivers feel safe in maintaining the posted speed limit.

With the growing popularity of liquid deicers, the market has become overwhelmed with different solutions and the efficiency of the deicers is not always certain. The criteria for the evaluation of the deicers include minimal environmental impact, low corrosiveness, high melting capacity, high longevity, and compatibility with equipment and materials. The evaluation process is not always simple. Some of the evaluations are easier to perform than others. There are laboratory studies for these assessments, but they require translation to the real-world application. From the results of a literature review and controlled field-testing, live field tests needed to be conducted to allow for accurate and realistic comparison of deicers.

As shown in Table 2.3, once the temperature drops below 15°F, rock salt and brine are not recommended at all without additives. When the temperature falls below 15°F, salt begins to lose effectiveness (Delapaz, et al. 2015). The inefficient uses of salt have led to an increased effort by winter maintenance teams to implement alternative liquid deicers. Brine is the most frequently used liquid by maintenance crews (Shi and Akin, 2010), amidst numerous commercial products. Brine, similar to rock salt, has reportedly been less effective at lower temperatures and may be corrosive to maintenance equipment and surrounding infrastructure (Clear Roads, 2015). Therefore, maintenance teams have explored liquid alternatives.

A combination of liquids and rock salt may be used for snow and ice control. Some maintenance crews apply deicers to the roads before the storm. This practice is called pre-wetting. Pre-wetting is a technique that uses a liquid chemical, deicer, to wet salt as it is being spread onto the road surface (TAC, 2013). Pre-wetting is commonly used to improve road conditions and keep material on the pavement by reducing the bouncing, blowing, and sliding of the salt (TAC, 2013). Shi and O'Keefe reference a study by the Transportation Association of Canada in 2004 that established pre-wetted rock salt retained at a rate of 96% when applied along the centerline compared to only 70% of dry rock salt (Shi and O'Keefe, 2005). However, this report focuses on direct liquid application (DLA). This form of application has many benefits including fast improvement of LOS, reduced application rates, reduced loss of material, prevention of bonding, and reduced corrosion effects (Peterson, 2010). The reduced corrosion effect reported by Peterson is derived from the dilution of the products where the granular chemicals are more concentrated (Peterson, 2010).



Ohio Department of Natural Resources

BOB TAFT, GOVERNOR

SAMUEL W. SPECK, DIRECTOR

Division of Mineral Resources Management

Michael L. Sponsler, Chief

2045 Morse Road, Bldg. H3

Columbus, OH 43229-6693

Phone: (614) 265-6633 Fax: (614) 265-7998

ORDER BY THE CHIEF

ORDER NO. 2004-82

TO: Duck Creek Energy, Inc.
7033 Mill Road
Brecksville OH 44141

RE: APPROVAL OF A NEW METHOD FOR BRINE DISPOSAL

The Chief of the Division of Mineral Resources Management ("Division") having given due consideration to the matter contained herein makes the following Findings and issues the following Orders:

FINDINGS

- 1) On March 8, 2004, the Division of Mineral Resources Management (Division) received a request from Chester Wilcox & Saxbe, L.L.P., on the behalf of Duck Creek Energy, Inc. for the approval of its product, AquaSalinaTM as a new technology for disposal of brine.
- 2) AquaSalinaTM is a saline product derived from brine produced at oil and gas wells.
- 3) Duck Creek Energy's process removes free oil and dissolved volatile organic compounds from the produced brine resulting in a saltwater liquid called AquaSalinaTM.
- 4) Based upon an evaluation of an analysis submitted to the Division, the concentration of metals (barium) and volatile organic compounds satisfy U.S. EPA Maximum Contaminant Levels for public drinking water.
- 5) Unlike untreated produced brine, AquaSalinaTM is a commodity, not a waste product for which users of AquaSalinaTM will be charged a fee. The recommended spreading rate for AquaSalinaTM is less than the maximum allowable spreading rate currently allowed by Section 1509.226(B)(5) of the Ohio Revised Code for raw brine. When spread at the recommended-rate, AquaSalinaTM will not cause, or cannot reasonably be anticipated to cause water consumed by humans or domestic animals to exceed the standards of the Safe Drinking Water Act or result in damage or injury to public health, safety or the environment.

ORDERS

- 1) Pursuant to Section 1509.22(C)(1) of the Ohio Revised Code (O.R.C.), the Division of Mineral Resources Management hereby conditionally approves the use of AquaSalina™ as a new technology for disposal of brine for de-icing road surfaces, or dust control, use in port-a-john restrooms, or other product applications so approved by the Division from time to time. Surface application of AquaSalina™ is exempt from compliance with Section 1509.226(A-F, H and I) of the O.R.C.
- 2) AquaSalina™ will only be transported and spread from Duck Creek Energy, Inc.'s processing facility with vehicles that are exempt under O.R.C. 1509.226(G) and that are not used for transportation of oilfield brine or other chemicals or substances that may be hazardous to public health or safety or by other dedicated vehicles that are not used for transportation of oilfield brine or other chemicals or substances that may be hazardous to public health or safety. Pursuant to 1509.226(G) because the disposal of AquaSalina™ under this Order is a new technology, such dedicated vehicles are exempt from the registration, disposal plan and surety bond requirements under 1509.222, 223 and 225 of the Ohio Revised Code.
- 3) Each entity which transports AquaSalina™ must legibly identify all vehicles used in the transportation thereof with reflective paint in letters no less than four inches (4") in height, indicating the words "Brine" and "AquaSalina™".
- 4) In order to minimize the concentration of barium, AquaSalina™ must be made only from raw production brine produced from reservoirs below the top of the Onondaga Limestone, including, but not limited to, the Oriskany Sandstone, Newburg Dolomite and Clinton Sandstone. AquaSalina™ cannot be derived from raw brine originating from drilling, completion stimulation, or treatment operations.
- 5) The exemptions set forth in condition one of this Order shall only apply to AquaSalina™ and not to the raw brine transported to Duck Creek Energy, Inc.'s processing facility. Raw brine must be transported to Duck Creek's processing facility by a registered brine hauler subject to the requirements of 1509.222, 1509.223 and 1905.225 of the Ohio Revised Code.
- 6) On or before the fifteenth day of April of each year, Duck Creek Energy, Inc. shall file an annual report with the Division for the previous calendar year. The report shall include at least the following information: Volume of raw brine transported to the facility by each individual registered brine hauler, the oil and gas well sources for the raw brine, including County and the API permit number, and the name and UIC brine hauler registration number for each hauler.
- 7) AquaSalina™ must meet U.S. E.P.A. Maximum Contaminant Level standards for Barium and Volatile Organic Compounds including Benzene, Ethyl benzene, Toluene, and Xylene (BETX).

- 8) Annually, Duck Creek Energy, Inc. will provide test results to the Division verifying that the processed AquaSalinaTM meets all applicable standards. The sample will be analyzed by a laboratory certified by the Ohio Environmental Protection Agency for the following parameters: Inorganics (chloride), Metals (barium, calcium, iron, magnesium, and sodium), and BTEX. The analysis must be submitted by April 15th of each year along with the Annual Report required by condition number six.
- 9) The Division may at any time collect samples of AquaSalinaTM for independent testing and analysis.
- 10) In the event that test results of AquaSalinaTM submitted by Duck Creek, or generated as a result of the Division's independent testing and analysis, raise concerns on the part of the Division that AquaSalinaTM does not comply with the requirements of condition number seven of this Order, upon notification by the Division, Duck Creek shall immediately cease distribution of AquaSalinaTM.
- 11) Distribution ceased pursuant to condition number ten shall not recommence until such time as Duck Creek, at its own expense, has submitted to the Division, additional test results by a laboratory certified by the Ohio Environmental Protection Agency verifying that AquaSalinaTM complies with the requirements of condition number seven. The Division shall give authorization to recommence such distribution within five days of the receipt of such test results.
- 12) Due to this Order being issued under O.R.C. 1509.22(C)(1) for testing or implementing of a new technology or method of disposal, this Order shall be in effect for 365 days after the date of issuance. If Duck Creek wishes an extension of this Order, it shall submit a request for an extension to the Chief of the Division by October 1, 2005.

October 22, 2004

Issue Date

Scott R. Kill for

MICHAEL L. SPONSLER, Chief
Division of Mineral Resources Management

ORDER NO. 2004-82
Duck Creek Energy, Inc.
Page 4

Addressee will be afforded an informal hearing, if requested, pursuant to Section 1509.06 of the Ohio Revised Code. If an informal hearing is desired, contact Michael L. Sponsler, Chief, Division of Mineral Resources Management, at (614) 265-6893.

Addressee is hereby notified that this action is final and effective and may be appealed to the Oil and Gas Commission pursuant to Section 1509.36 of the Ohio Revised Code. The appeal must be in writing and must set forth the Orders complained of and the grounds upon which the appeal is based. Such appeal must be filed with Benita S. Kahn, Secretary, Oil and Gas Commission, c/o Vorys, Sater, Seymour & Pease, 52 Gay Street, P.O. Box 1008, Columbus, Ohio 43216, within thirty (30) days after receipt of this Order.

In addition, notice of the filing of the appeal must be filed with Michael L. Sponsler, Chief, Division of Mineral Resources Management, 2045 Morse Road, Bldg H-2, Columbus, OH 43229-6693, within three (3) days after the appeal is filed with the Oil and Gas Commission.

Cc: Tom Tomastik, Geologist
Ray Studer, ODNR Attorney General
Dave Hodges, Geology Program Supervisor
Scott Kell, Deputy Chief
Tom Tugend, Deputy Chief
Rick Simmers, North Region Manager
Dave Clark, South Region Manager
Bill Boyle, West Region Manager
Duck Creek Energy, Inc. Brine Hauler File

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Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID M. SMITH, DIRECTOR

February 10, 2011

Mr. Dave Mansbery
Duck Creek Energy, Inc.
7033 Mill Road
Brecksville, Ohio 44141

Dear Mr. Mansbery:

Pursuant to our telephone conversation on February 9, 2011, below is the excerpt from the Administrative Order 2004-82 issued to Duck Creek Energy, Inc. on October 22, 2004.

- Pursuant to Section 1509.22 (C) (1) of the Ohio Revised Code, the Division of Mineral Resources Management (Division) hereby conditionally approves the use of AquaSalina as a new technology for disposal of brine for de-icing road surfaces, or dust control, use in port-a-john restrooms, or other product applications so approved by the Division from time to time. Surface application of AquaSalina is exempt from compliance with Section 1509.226 (A-F, H and I) of the Ohio Revised Code.
- This exemption means that AquaSalina can be applied to road surfaces without obtaining a resolution from the county and does not have to adhere to the nine guidelines required for the spreading of untreated oilfield brine under Section 1509.226 (B) of the Ohio Revised Code.

If you have any further questions regarding this matter, please feel free to contact me at (614) 265-1032.

Sincerely,

Tom Tomastik, Geologist 4
Division of Mineral Resources Management
2045 Morse Road, H-3
Columbus, Ohio 43229-6693

Cc: File

EVALUATION AND ANALYSIS OF LIQUID DEICERS FOR WINTER MAINTENANCE

BACKGROUND

The single largest cost item in the maintenance budget for the Ohio Department of Transportation (ODOT) is snow and ice control. ODOT utilizes mechanical and chemical methods to combat ice and snow from gathering on the roadways, which creates unsafe driving conditions. This research focuses on evaluating chemically removing ice and snow through the use of liquid deicers. There are a plethora of liquid deicers commercially available. ODOT's Boston Heights garage along with Chardon Township will work with the research team to test these liquid deicers under various traffic and weather conditions. Figure 1 presents field testing on a no volume road. In addition to reviewing the performance of these deicers in the field, lab testing will be conducted to study the behavior of the deicers in a controlled environment. Figure 2 presents the methodology for the ice melting capacity test conducted in the lab.

KEY FEATURES AND APPLICATIONS

1. Traffic is a key role in the performance of the deicers.
2. Deicers have performed well when road temperatures are nearing 0°F. Normally ODOT would not apply any liquid deicers for the fear of freezing.
3. All deicers performed similar in the field under the weather conditions observed.
4. Based on performance and then cost, brine is recommended for temperatures $\geq 21^{\circ}\text{F}$. Brine performed fair (not good) from 15°F to 21°F. Deicer D is the best for temperatures between 0°F to 7.5°F. Note See Figure 5 and 6 below for more details.

RESEARCH CONTEXT

The objectives of this project are to:

- Determine the deicers that are compatible with ODOT's equipment and materials with the highest melting capacity,
- Conduct lab and field tests to evaluate deicers under various temperature, environmental, and roadway conditions,
- Recommend deicers for various conditions that based on cost, ice melting capacity, longevity, compatibility and availability, and
- Evaluate the feasibility of implementation for liquid deicers.



Figure 1: Field Testing on a No Volume Road Section.

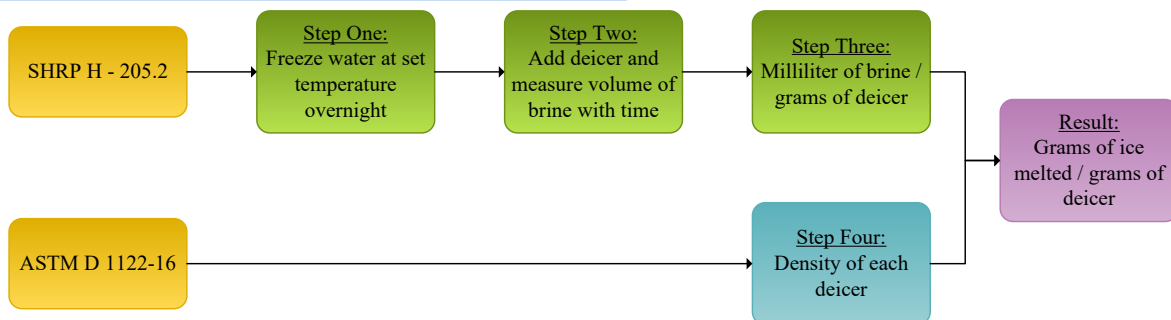


Figure 2: Ice Melting Capacity Lab Test Procedure.

EVALUATION AND ANALYSIS OF LIQUID DEICERS FOR WINTER MAINTENANCE

RESEARCH APPROACH

The study began with parking lot tests and there was little to no effect from any deicers proving that traffic is needed. The study progressed to a low volume road, and then a medium volume road. Deicers are applied to zones with 0.5 miles between each deicer to avoid contamination from traffic. Figure 3 presents the two application systems built for this research. Friction and road temperature measurements are taken of each zone over time till deicers are no longer functioning. Figure 4 presents the road temperature and visual comparison data. Figure 5 presents the friction data. The next phase is moving to medium volume roads.

Three lab test were performed: ice melting (SHRP H 205.2), ice penetration (SHRP H 205.3), and freezing point (ASTM D1177-12). All test were ran with the pure deicers and with a mixed (brine and deicer) solutions as well. Ice melting and penetration were conducted at 0°F, 15°F, and 25°F. Ice melting was conducted at 18°F and 7.5°F for a few deicers and blends as well.

RESEARCH FINDINGS AND RECOMMENDATIONS

Field testing has shown that the mixing of deicers by traffic is key to the individual deicers success. For the most realistic results the deicers should be evaluated under the most similar circumstances. The average temperature observed in the field is 21°F there are two events when temperature are 20°F however, all the deicers and brine failed at the same rate due to the amount of snowfall. Therefore, recommendation for $\geq 21^\circ\text{F}$ are based on field data while recommendations for 0°F to 21°F are based on the lab data.

Figure 5 and 6 presents the historical temperature data for the state of Ohio. As seen there is a 1% chance the temperatures are below 0°F. Figure 5 presents all the deicers and deicer blends (brine and deicer mixed) that performed well in that temperature range. Figure 6 presents the recommended one based on cost per gallon.



Figure 3: Application Systems (left is for no volume and right is form low/medium volume application)

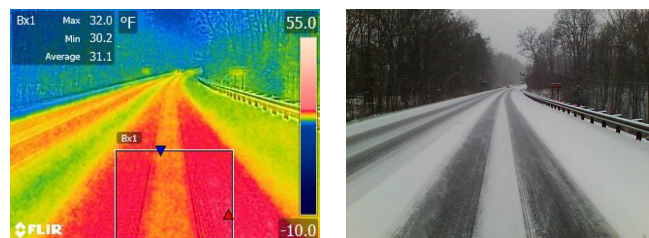


Figure 4: Images Taken During Field Test.

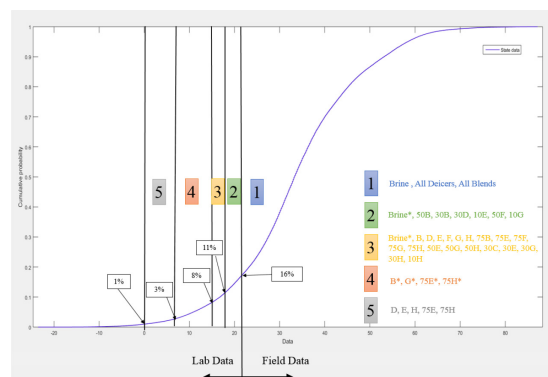


Figure 5: Results from Lab and Field.

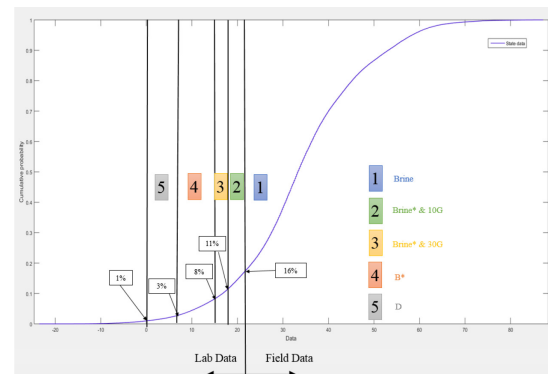


Figure 6: Recommended Based on Lowest Cost per Gallon from Deicer in Figure 5.

Nature's Own Source, LLC

AquaSalina®
Liquid Deicer & Dust Suppressant

AquaSalina+®
Corrosion Inhibited Liquid Deicer & Dust Suppressant
PNS-QPL Listed Product

NO



YES



JUST LOAD AND GO!

AquaSalina® Products

NO Capital ~ **NO** Labor ~ **NO** Maintenance
LOWER Temperature Range ~ **LOWER** Total Cost
Environmentally Friendly

AQ+IceBite

Corrosion Inhibited Liquid Deicer & Salt Activator
PNS-QPL Listed Product

7033 Mill Road
Brecksville, OH 44141

440.838.5135

www.naturesownsource.com

AquaSalina® a natural saltwater solution originating from ancient seas. It replaces manufactured salt brine, and calcium and magnesium chloride solutions.

AquaSalina+® corrosion inhibited AquaSalina® (PNS Approved and QPL Listed)

AquaSalina® and *AquaSalina*+® Both products are used effectively for deicing or anti-icing, and have a certified freeze point of -15°F, unlike manufactured salt brine whose freeze point is -6°F. Safely apply to road surfaces, or pre-wetting rock salt. Filtered to 5 micron thus, no plugging of nozzles, no freezing of salt into blocks at the spinner, and no unpleasant odor or stickiness. **Just Load and Go!**

- 1 ½ times more ice melting capacity than manufactured salt brine
- Requires NO capital expenditures for brine makers
- Requires NO rock salt - Pre-treat reduces rock salt consumption 30%
- Requires NO chemical additions or mixing - **Just Load and Go!**
- Requires NO maintenance - Filtered to 5 micron
- Environmentally friendly - Adds to the water cycle - Why foul freshwater to make brine?
- Economically replaces manufactured salt brine, and calcium and magnesium chloride solutions
- Anti-ice, and pre-treat salt, grit, and #9 limestone
- Pre-treat secondaries - prevents snow pack, easier clean-up - Buys time for mains
- Has **70% less corrosive effect than manufactured salt brine**
- Top Performer in the December 28, 2013 Western Transportation Institute at Montana State University Final Report *"If one desires to reduce the need for plowing, then de-ice using Product A (AquaSalina)..."*

NEW AQ+IceBite

- Combines AquaSalina+® with Ice Bite® (85/15%)
- Reduce bounce and scatter - Good retention on road
- Premixed - **Just Load and Go!**
- PNS certified freeze point at -11°F
- Environmentally friendly - Renewable beet addition to re-purposed saltwater
- **70% less corrosive than manufactured salt brine**
- **The ONLY combined brine and beet corrosion inhibited product meeting PNS Specifications and QPL Listed**

All naturally contain calcium, sodium, magnesium and potassium chlorides, resulting in lower freeze points and better resistance to dilution than manufactured salt brine.

TESTIMONIALS:

Chardon Township, Ohio: "The product performed great burning ice away from the pavement at a pavement temperature of -5°F and an ambient air temperature of -10°F."

City of Green, Ohio: "We have had great success with AquaSalina. When we experienced the below zero temperatures, the product performed without freezing while using it down to -9°F."

Nature's Own Source, LLC * 7033 Mill Road * Brecksville, OH 44141 * 440.838.5135 * www.naturesownsource.com
Plants and Terminals: Cleveland, OH Mogadore, OH

Patent Pending 04/2015