Proponent Testimony on Senate Bill 171
Dave Mansbery, Owner, Nature's Own Source (producer of AquaSalina)
Senate Agriculture & Natural Resources Committee
Tuesday, May 25, 2021

Chairman Schaffer, Vice Chair Huffman, Ranking Minority Member Fedor and members of the Senate Agriculture & Natural Resources Committee thank you for the opportunity to provide proponent testimony today on SB 171. My name is Dave Mansbery and I'm the owner of Duck Creek Energy, Inc. and Nature's Own Source, LLC which processes raw saltwater brine from conventional oil and gas wells into a 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 non shale oil and gas 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 the unprocessed oily, dirty salt water for snow and ice control – 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 obtain a permit for the processing facility and to process raw brine into a finished product or commodity which has been demonstrated to be safe over almost 20 years of use ODNR's job is complete. The standards in this bill accomplish this goal with appropriate government oversight.

Duck Creek Energy and Nature's Own have been producing ***AquaSalina*** at its Cleveland facility since ODNR provided a Chief's Order in 2004 approving the process. 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 mined rock salt or raw unprocessed brine to help keep roads, sidewalks and other surfaces safe when temps get as low as -15 degrees – far below temperatures where rock salt is effective .

We have been working with ODNR on a solution, but the statute needs to be revised in order to provide additional guidance for private sector users of the product. 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 to remove oil and gas constituents, anyone using our product must register as a UIC ("brine") hauler, pay the $50 fee, as well as track and report to ODNR where they use our product and how much is used. That includes anyone who decides to go purchase a 2-gallon container of my product at retail stores across the state. 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.

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 with a unique mix of calcium ions. It can deice to -15 degrees. It also eliminates the need for public and private entities to use large quantities of fresh water to mix with mined salt to make brine for road treatments. Independent studies prove that using liquids, like AquaSalina, 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 apply 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 circumstances, ***AquaSalina*** is absolutely the most environmentally friendly out of all surface application options.

Supplemental Material Supporting SB 171

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.

Opponents have raised concerns about radiation, but I would like to note that the **Ohio Department of Health (ODH)** concluded on March 19, 2018 that application of this material poses a negligible radiological health risk to public health and safety. The results of these models are conservative. The additional ODNR radiation test conducted over the last year supports ODH's conclusion.

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 and the Ohio Turnpike Commission.

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

For every gallon of raw brine produced into AquaSalina we save one more gallon of fresh water from being fouled with salt and one more gallon not being injected into a brine disposal well. Duck Creek's two facilities can process much more raw brine, but cannot do so until there is certainty, particularly for private sector users, in the statute. This bill provides that certainty for users as well as the public through science based standards that Dr. Bill Rish will go into detail after my testimony.

Conclusion

Mr. Chairman and members of the committee we should be promoting small businesses like Duck Creek Energy and the innovative solutions to industry problems like oil and gas brine disposal 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 (at no cost to the Producer) from conventional formations, like the Clinton , and process it to make a useful product rather than paying to have it pumped 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 applying mined rock salt, raw brine or fouling fresh water with salt to make man-made brine. I hope you agree that SB 171 is good public policy. The state should encourage more companies to find useful ways to use such byproducts rather than making it more difficult to do business.

I'll note that the 132nd General Assembly Ohio House of Representatives passed a similar bill in 2018, but by then the Senate didn't have enough time to move it through the legislative process. Since then we have continued testing our product with ODNR to address concerns raised by opponents. In addition, this legislation proposes additional scientific standards for anyone wanting to process and recycle brine into a product/commodity as I have done with AquaSalina. Dr. Rish will give more detail.

Thank you for your time and attention. I want to thank Sen. Michael Rulli and Sen. Frank Hoagland for introducing SB 171. I, along with my legislative counsel, Tony Fiore from Kegler Brown Hill + Ritter, would be happy to answer any questions.

Supplemental Material Supporting SB 171

- ***What is vertical well brine water?*** 400 million year old ancient seawater trapped in rock is brought to the surface with oil and gas production
- Duck Creek Energy/Nature's Own recycles this water into a product called AquaSalina.
- The product, a liquid form of salt, is more effective than rock salt because it melts ice at a lower temperature - approximately 30% of rock salt is lost due to bounce and scatter when applying to the rock salt to roads and surfaces. Pre-wetting salt with AquaSalina reduces scatter/waste.
- Less chlorides in our lakes, rivers and streams = a positive environmental impact.
- It also reduces the fouling of fresh water to make fabricated salt brine, an inferior product because rock salt brine is only effective to plus 15-20°F.
- The roads are safer for the public by using AquaSalina because rock salt brine loses its effectives below 15-20°F - AquaSalina is certified to -15°F and has been used on the roads at -12°F.
- Safer roads means less loss of life and reduced costs of accidents.
- AquaSalina is 70% less corrosive on our vehicles/infrastructure than fabricated brine/rock salt.
- Unlike rock salt contracts, state and local governments and private users are only charged for the product when ordered – there are no "take or pay" contracts where payment is required annually regardless of how much product is used.
- Through recycling, less raw brine is being placed on our roads or into Class II Injection wells.
- Approximately 70% of the AquaSalina water evaporates adding to the fresh water cycle.
- AquaSalina raw brine is sourced only from the conventional wells.
    - **AquaSalina is NOT FRAC WATER**. "Fracwater" is mostly freshwater and freshwater does not melt ice. "Fracwater" is NOT accepted at Nature's Own facilities. Chlorides melt ice. "Fracwater" does NOT. "Fracwater" would dilute AquaSalina and that is not acceptable.
    - **AquaSalina is NOT SHALE WELL WATER**. Shale water is NOT accepted at Nature's Own facilities. Again, this water is not suitable for melting ice and it is against the law to use this production water. Anyone claiming as such is making a factually inaccurate statement.
- The **Ohio Department of Transportation** and the **Pennsylvania Department of Transportation** have thoroughly studied AquaSalina through various University studies (Ohio - Montana State (12/2013) and Akron University (9/2017); Pennsylvania – Temple University (10/2015).
- The **Ohio Department of Natural Resources (ODNR)** concluded AquaSalina does NOT produce TENORM (Technologically Enhanced Naturally Occurring Radioactive Material) (8/9/2019) resulting from human activity that has concentrated the radioactivity or increased the likelihood of exposure by making the radioactive material more accessible to human contact as environmental groups have inaccurately stated.
- Additional testing requested by **ODNR** confirmed negligible radiation concern. Nature's Own employees carried radiation sampling devices at its facilities showing **ZERO** (0) exposure during October 2020 through January 2021 (the most active use timeframe). The important analogy is that any government or private sector individuals using AquaSalina should experience the same results.
- The **Ohio Department of Health (ODH)** concluded on March 19, 2018 that application of this material poses a negligible radiological health risk to public health and safety. The results of these models are conservative. The additional ODNR radiation test supports ODH's conclusion.

Supplemental Material Supporting SB 171

Raw "Brine" Can Be Used on Ohio Roads Today – This bill cleans it up

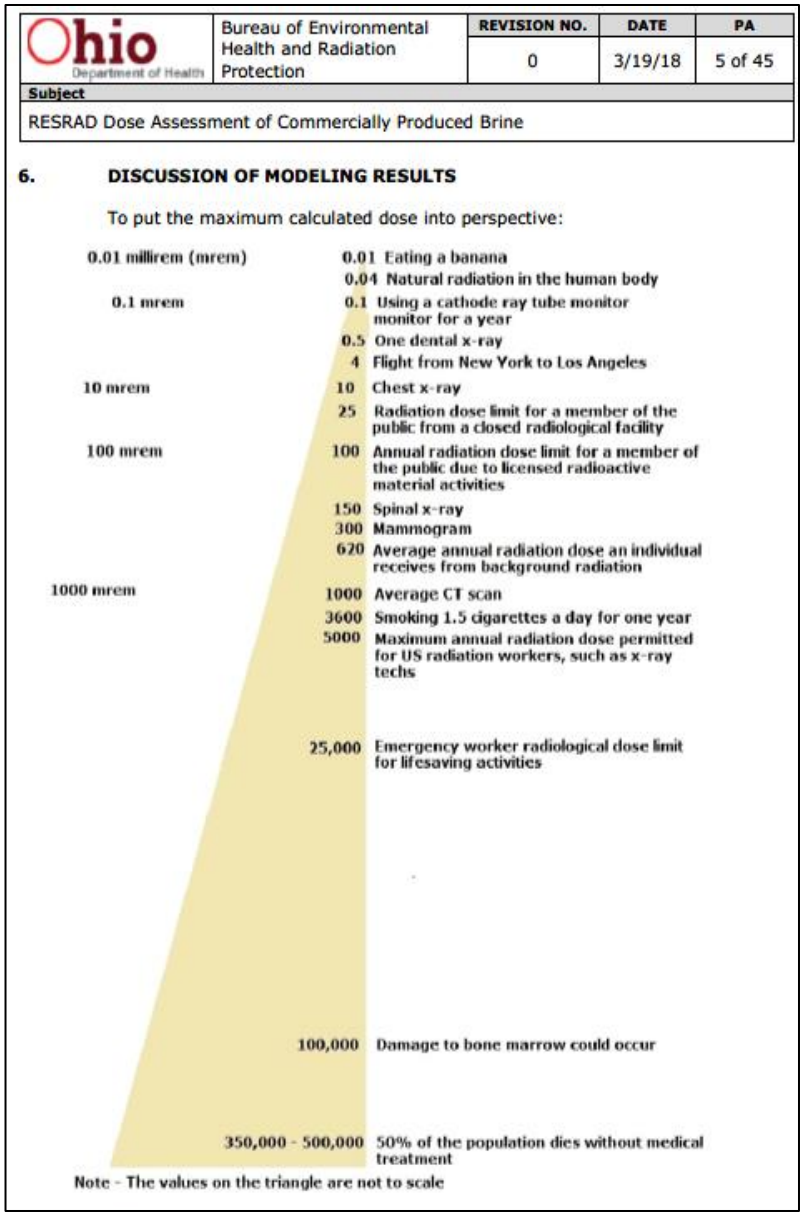
The goal of this legislation is to encourage the processing and recycling of "brine". ORC 1509.01 (U) defines "brine" as "all saline geological formation water resulting from, obtained from, or produced in connection with exploration, drilling, well stimulation, production of oil or gas, or plugging of a well." This raw "brine" can legally be spread on the ground today as long as the hauler registers as a BRINE hauler, pays the $50 fee and tracks and reports back to the Ohio Department of Natural Resources (ODNR) where it was spread. Local governments need to pass a resolution to do so. Raw brine is where environmental groups and the government's concern should remain, not brine that has been processed, recycled and independently tested to be transformed into a commercial product like AquaSalina.

Duck Creek Energy/Nature's Own, removes the residual petroleum contaminants out of this raw brine and uses carbon filters to filter the clean brine solution down to 5 microns. Then, vitamin C is added to keep any iron molecules in the water from oxidizing and along with a corrosion inhibitor similar to liquid found in IV bags used in hospitals to hydrate humans. A food grade dye is then used (either blue or green) to make sure ODOT and other users know how much solution is in their tank. This dye is UV sensitive, so it disappears when light hits it. What is left is a solution that has 7-11% sodium chloride, 8-10% calcium chloride, 2-2.5% magnesium chloride and .5-1.5% potassium chloride all naturally occurring substances found in bottled water in smaller quantities. The clear and blue liquid in the picture above are processed/recycled brine that has been viewed by ODNR as a "product/commodity" since 2004. If AquaSalina is dehydrated (pictured on the right) the remaining granules are not subject to ODNR regulation.

Radiation is everywhere and in everything

Understand that almost everything contains some natural level of radioactivity. The brine water forming AquaSalina contains solid particles with natural levels of radioactivity. **Sand and rock salt also contain natural radioactivity, but neither are tested prior to public sale or use.** According to the **Ohio EPA**, every day we are exposed to normal background radiation that is present in the environment from natural sources. These sources include radiation from the sun, cosmic rays, food and water, and radiation from naturally occurring elements in the soil and rocks. In Ohio, the background radiation average ranges from 473 to 620 millirem per year, which is the typical unit of measure for radiation exposure. According to the **U.S. EPA**, the average background radiation exposure to people living in the United States is approximately 360 millirem per year.

It is helpful to compare the radiation exposure levels from oil and gas brine used for deicing to natural background radiation exposure levels. In a recent study the **Pennsylvania Department of Environmental Protection (PADEP)** did extensive sampling of radiation along 32 roads treated with oil and gas brine. They used this data to estimate a maximum human exposure level of approximately 0.5 millirem per year from the brine radiation. This maximum exposure level from deicing roads with brine is extremely small, less than two tenths of a percent of natural background exposure levels. We can have confidence in this conclusion of very low exposure because (1) it is based on actual measured levels, (2) PADEP conservatively assumed a hunter or jogger exposed to radiation from the road and soils along the road by external "shine" radiation, inhalation and swallowing of dust from the affected soil and road (at an elevated inhalation rate), radon, consumption of plants grown in the affected soil, consumption of meat from cattle grazing on the affected soil, and consumption of milk from cows grazing on the affected soil, and (3) Pennsylvania is known as one of the strongest regulators of radiation and the oil and gas industry.



Ohio Department of Health	Bureau of Environmental Health and Radiation Protection	REVISION NO.	DATE	PA
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Subject

RESRAD Dose Assessment of Commercially Produced Brine

6. DISCUSSION OF MODELING RESULTS

To put the maximum calculated dose into perspective:

Note - The values on the triangle are not to scale

As further evidence of how radiation from brine deicer compares to natural background levels of radiation, in a recent published study by Penn State University, scientists tried to maximize runoff levels of radiation from untreated oil and gas brine into nearby soils. After repeated attempts to build up radiation, they could get no higher than 4 picocuries of radiation per gram of soil and roadbed material. They concluded that "In all cases, radium concentrations were below the regulatory standard of 5 picocuries per gram of soil above background for remediating land surfaces impacted by radioactive waste materials." But, picocuries per gram is a measure of concentration, not exposure, and exposure is a requirement of risk. To compare to natural background exposure, assuming a resident is living on 2.5 acres of this oil and gas brine impacted soil, their estimated exposure level to radioactivity is a maximum of 4 millirem per year as compared to natural background exposure levels of over 100 millirem per year.

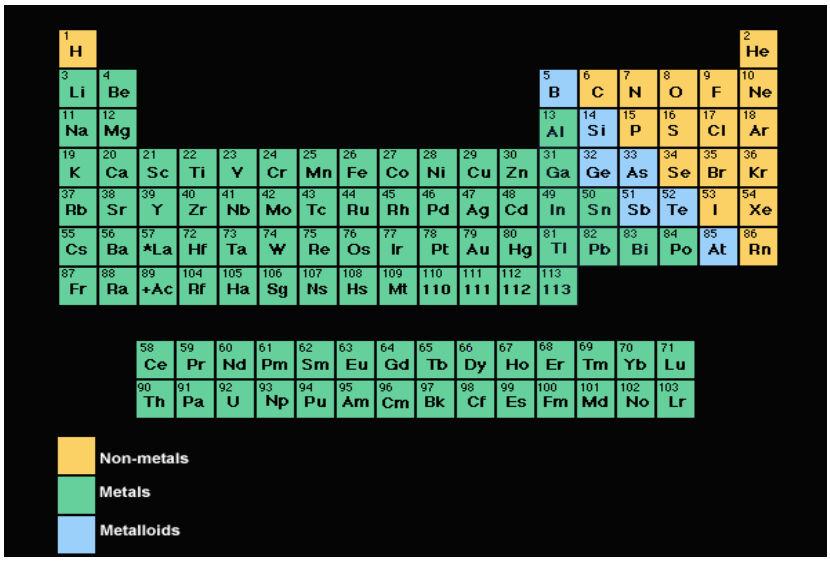
This assumes that the resident tends a garden, eats vegetables grown in this soil, inhales and swallows dust, eats meat from cattle grazing on the affected soil, consumes milk from cows grazing on the affected soil, and drinks from a well extracting groundwater into which radioactivity has leached from the affected soil none of which is likely on property immediately adjacent to a treated roadway. The results of these models are conservative. In explaining how insignificantly low the levels of radiation are from AquaSalina, the **Ohio Department of Health (ODH)** (diagram above) concluded on March 19, 2018 that application of this material poses a negligible radiological health risk to public health and safety.

No "frac" or "shale" water will ever be used

This legislation makes clear that no "frac" or "shale" water will be used for this process. The phrase that ensures such water will not be used is brine "that is not from a horizontal" well. "Horizontal well" is defined in the Ohio Revised Code 1509.01 (GG) as "a well that is drilled for the production of oil or gas in which the wellbore reaches a horizontal or near horizontal position in the Point Pleasant, Utica, or Marcellus formation and the well is stimulated." These are the shale formations. The source of the raw brine used to produce AquaSalina is confirmed and tracked by the fact that every gallon of brine that comes from conventional oil and gas well to a Nature's Own facility for processing into AquaSalina is reported to the ODNR today and will continue to be when this bill becomes law. In addition, "frac" water does not have the same ice melting properties as conventional well water and does not result in a useable product. Therefore, any assertion that this permits use of "frac" or "shale" water in this process is simply **false**.

Trace Amounts of Metals in AquaSalina Are Not Alarming

Most elements in nature are metals. Look at the table of earth's elements below.



In the environmental world, the term "heavy metals" was created to refer to the more dense metals. Like all metals these can be toxic if taken into the body at high enough levels. Some of these "heavy metals" are also essential nutrients for good health when taken into the body at proper levels. That is why vitamin tablets contain them. **In fact, based on laboratory analysis of AquaSalina, taking one vitamin containing the recommended daily amount of chromium, copper, selenium, and zinc puts more of these metals (factors of 42, 47, 3, and 78 respectively) into the body than would drinking an 8 ounce glass of AquaSalina (not recommended and not processed for human consumption)**.

"Heavy metals" (and all metals) occur naturally in soil and waters in the environment. Ohio EPA has issued an "Evaluation of Background Metal Soil Concentrations" (Updated August 24, 2017) for several counties across Ohio. You can find the report by clicking here. These background levels are used as cleanup levels for Ohio regulatory programs.

The following concentrations of metals are in natural background soils in Ohio:

- Arsenic 13 to 24 mg/kg
- Cadmium Approximately 1 mg/kg
- Chromium 16 to 21 mg/kg
- Lead 22 to 52 mg/kg
- Mercury Approximately 0.1 mg/kg
- Selenium Approximately 1 mg/kg
- Thallium 0.35 to 0.75 mg/kg
- Nickel Approximately 36 mg/kg

Objective Standards that are Reasonable for Processing Brine

The state should be encouraging and supporting Nature's Own and other companies to process and recycle brine into a useful product/commodity that can be reused. The Clear Roads Group (formerly the Pacific Northwest Snowfighters (PNS)) standards to become a qualified product are rigorous. In fact, while AquaSalina was tested and has become a qualified product by PNS, rock salt and man-made brine (rock salt fouling fresh water) would certainly not due to their corrosive nature. AquaSalina is 70% less corrosive than rock salt and several independent studies by Ohio Department of Transportation (by Montana State and Akron University) as well as Pennsylvania Department of Transportation (by Temple University) confirm that AquaSalina is a safer environmental alternative for anti-icing and de-icing in the winter.

ODNR first approved processing/recycling raw brine into AquaSalina in 2004. For over a decade, it deemed the finished product a commodity which was not subject to further regulation. Every year, ODNR has received an annual lab analysis to confirm the treatment process is effective. The legislation increases sampling frequency and provides for up to 4 samples per year, if ODNR believes there is cause for concern.

ODNR was on the right track when it issued the Chief's Order in 2004 and renewed it every year thereafter until 2015 to promote the processing/recycling of brine. Enacting this legislation furthers that policy direction and serves several purposes.

- More brine processed to AquaSalina = less water in Class II injection wells and less dirty raw brine being spread on roads in Ohio.
- The lower freezing point of AquaSalina means drivers are safer on Ohio roads in the winter.
- AquaSalina being 70% less corrosive than rock salt means less wear and tear on state and local government vehicles and infrastructure as well as on our own vehicles.

Conclusion

Products, like AquaSalina, must be deemed a commodity in the future in order for it to compete with other products on the market used to keep our roads safe from ice in the winter, suppress dust in the summer and an alternative to harsh chemicals used to sanitize portable toilets. If not, public and private users will either choose not to use the product or create enormous compliance issues for ODNR. This legislation contains the right safeguards for Ohio and ODNR to continue to promote the processing/recycling of brine.

In 2004, the Ohio Department of Natural Resources 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)

- "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

- "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."

Supplemental Material Supporting SB 171

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 comparing the pH levels of common foods and liquids.

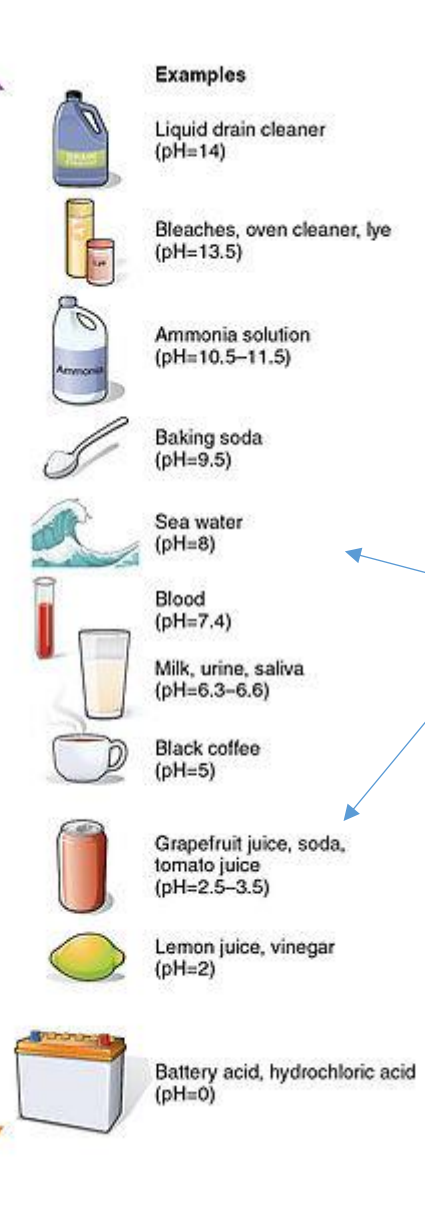
Diamond Creek Bottled Water Sourced in Columbiana County, Ohio has a pH of 9.5

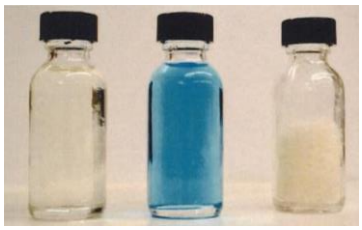
Icelandic Glacial Natural Spring Water from Iceland has a pH of 8.4

Waiakea Volcanic Bottled Water from Hawaii has a pH of between 7.6 and 8.2

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%

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. Processing and reusing vertical well brine reduces the need to foul fresh water with rock salt to create man-made brine.

ODOT due diligence before utilizing **AquaSalina™** in 11 of 12 Districts as well as the Ohio Turnpike to keep Ohio roads safer during bad weather.

Supplemental Material Supporting SB 171

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

Clear Roads Group

Clear Roads is a national research consortium focused on rigorous testing of winter maintenance materials, equipment and methods for use by highway maintenance crews.

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.

Primary Activities:

- 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.

Click here to learn more about the Clear Roads Group.

Pacific Northwest Snowfighters (PNS)

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).

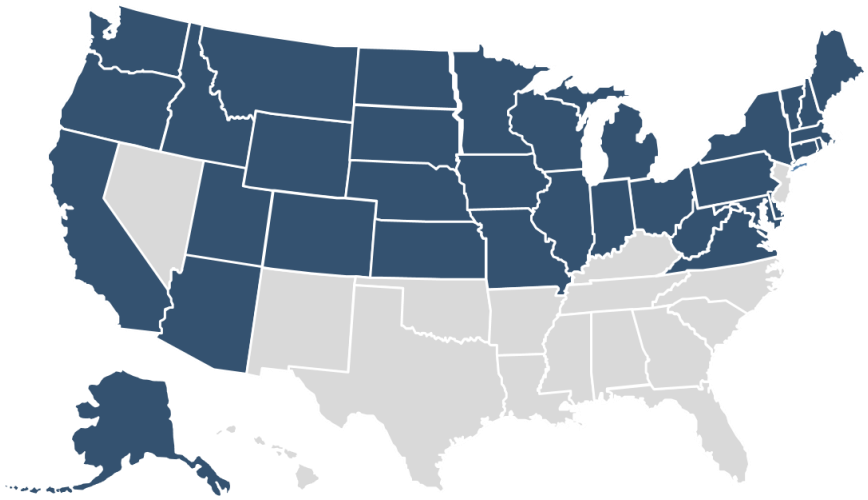
PNS is an association of transportation agencies dedicated to ensuring the safety of winter maintenance products through structured testing and evaluation. The group established procedures for testing deicing and anti-icing chemicals and maintains specifications that these products must meet to be considered for widespread use. PNS has become a nationally recognized leader in establishing and standardizing chemical products for snow and ice control.

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:

- Pass a series of tests for friction, corrosion, and chemical and toxicological properties
- Meet environmental and health standards.

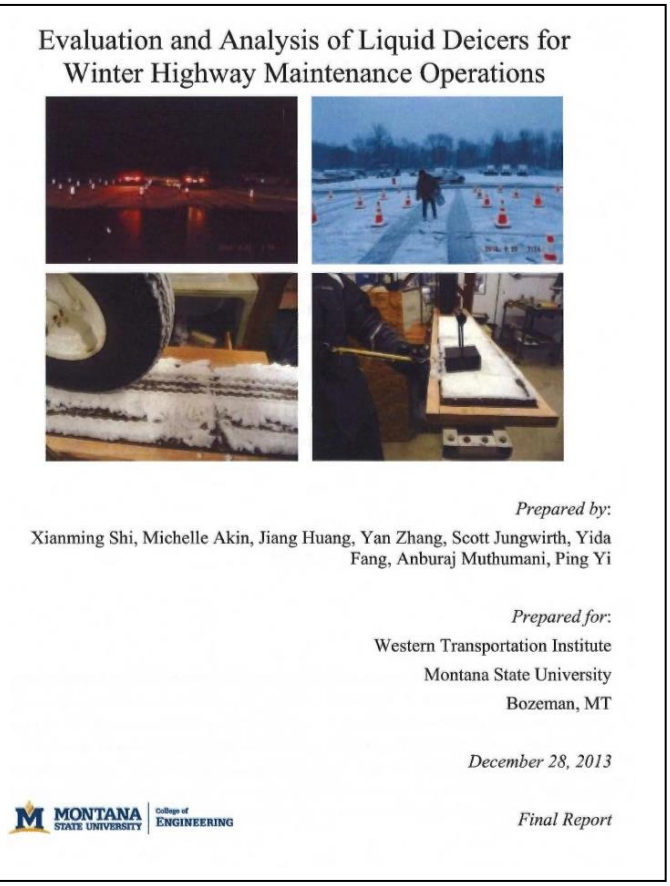
Click here to learn more about PNS.

Member states of the Clear Roads Group



Supplemental Material Supporting SB 171

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



Evaluation and Analysis of Liquid Deicers for Winter Highway Maintenance Operations

Prepared by:
Xianming Shi, Michelle Akin, Jiang Huang, Yan Zhang, Scott Jungwirth, Yida Fang, Anburaj Muthumani, Ping Yi

Prepared for:
Western Transportation Institute
Montana State University
Bozeman, MT

December 28, 2013

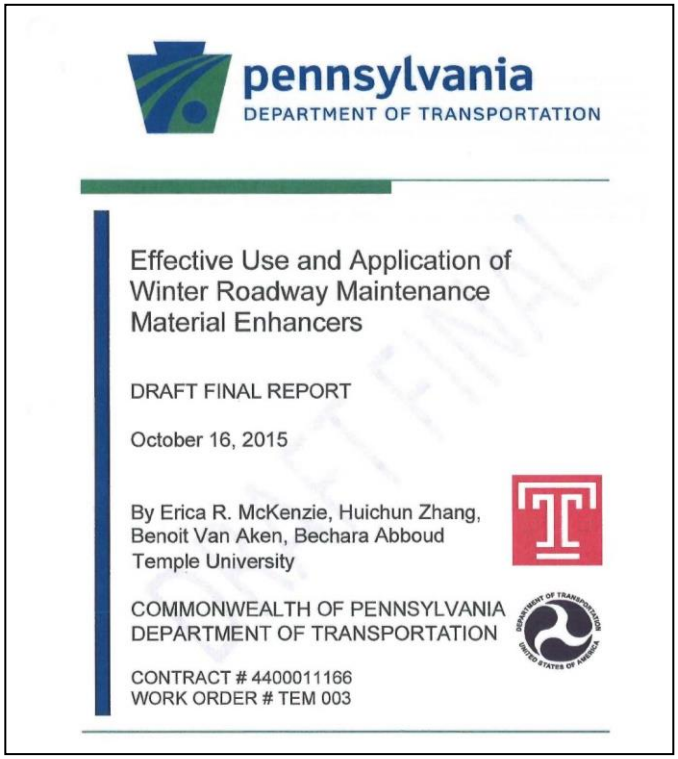
MONTANA STATE UNIVERSITY | College of ENGINEERING

Final Report

- "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 $MgCl_2$ 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 $MgCl_2$ and brine for anti-icing resulting in: 1) reduction of accidents, 2) rapid bare lane regain times, and 3) less deicer usage.

For relatively high traffic volume roads under light snowfall	**For low traffic volume roads under light snowfall**:	**For relatively high traffic volume roads under heavy snowfall** –
○ **Pavement temperature 15°F -20°F**: ▪ 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**: ▪ Anti-icing using salt brine at 20-40 gln/l-mi or **AquaSalina™** at 23-46 gln/l-mi; De-ice using salt brine or B20-SB80 at 20-30 gln/l-mi.	○ **Pavement temperature 15°F - 20°F**: ▪ 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**: ▪ Anti-icing using I25-SB75 at 20-30 gln/l-mi; ▪ De-ice using salt brine at 20-30 gln/l-mi.	○ **Pavement temperature 15°F - 20°F**: ▪ 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-prewet-salt at 16 gal/ton and 400 to 650 lb/l-mi. ○ **Pavement temperature 25°F – 30°F**: ▪ Plow frequently while giving sufficient time for deicer to work after its application; ▪ De-ice using Product-C-prewet-salt at 8 gal/ton and 250 to 350 lb/l-mi.

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


pennsylvania
DEPARTMENT OF TRANSPORTATION

Effective Use and Application of Winter Roadway Maintenance Material Enhancers

DRAFT FINAL REPORT

October 16, 2015

By Erica R. McKenzie, Huichun Zhang, Benoit Van Aken, Bechara Abboud
Temple University

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

CONTRACT # 4400011166
WORK ORDER # TEM 003

- "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 Pennsylvania Department of Environmental Protection – May 2016

TECHNOLOGICALLY ENHANCED NATURALLY OCCURRING RADIOACTIVE MATERIALS (TENORM) STUDY REPORT

Rev. 1

May 2016

Prepared for:

pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION

Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101

Prepared by:

PermaFix environmental services
A Nuclear Services and Waste Management Company

Perma-Fix Environmental Services, Inc.
325 Beaver Street, Suite 3
Beaver, PA 15009

Table 7-3. Road-Biased Soil – Uranium Series Gamma Spectroscopy Results

Study ID	U-238 (pCi/g)	Ra-226 (pCi/g)	Pb-214 (pCi/g)	Bi-214 (pCi/g)
BR-01-SL-001	0.905	2.57	1.36	1.30
BR-04-SL-010	1.08	2.03	0.959	0.872
BR-04-SL-011	< 2.75	1.51	0.991	0.985
BR-05-SL-009	0.792	2.12	1.03	0.932
BR-06-SL-004	< 1.54	2.05	0.891	0.858
BR-12-SL-005	< 1.96	1.81	1.02	1.03
BR-14-SL-013	< 1.45	2.98	1.90	1.82
BR-15-SL-014	1.63	2.55	1.31	1.22
BR-17-SL-016	< 0.901	2.22	1.17	1.07
BR-19-SL-018	< 1.19	1.44	0.598	0.587
BR-21-SL-020	1.27	4.57	2.86	2.69
BR-23-SL-022	1.81	4.38	2.32	2.18
BR-24-SL-023	< 1.03	4.22	2.85	2.67
BR-25-SL-024	1.19	6.96	4.89	4.48
BR-28-SL-027	1.50	3.07	2.02	1.74
BR-29-SL-028	1.52	2.50	1.20	1.15
BR-31-SL-030	< 0.599	1.93	0.840	0.822
BR-33-SL-032	0.624	1.53	0.820	0.751
BR-34-SL-033	0.605	1.22	0.648	0.564
BR-35-SL-034	0.949	1.65	0.867	0.811
BR-37-SL-036	0.790	1.75	0.842	0.771
BR-39-SL-038	< 0.912	1.14	0.638	0.625
BR-40-SL-039	0.930	< 0.057	0.458	0.507
BR-42-SL-040	0.562	1.35	0.626	0.561
BR-43-SL-041	< 0.563	1.18	0.635	0.613
BR-44-SL-042	0.931	1.95	0.909	0.830
BR-45-SL-043	< 0.720	< 0.070	0.590	0.763
BR-47-SL-045	1.39	0.970	0.481	0.443
BR-48-SL-046	< 1.02	1.45	0.716	0.725
BR-49-SL-047	0.696	1.30	0.595	0.547
BR-50-SL-048	0.865	1.99	1.02	0.949
Average	0.882	2.14	1.23	1.16
Std. Dev.	0.410	1.38	0.932	0.852
Median	0.792	1.93	0.909	0.858
Minimum	0.282	0.029	0.458	0.443
Maximum	1.81	6.96	4.89	4.48

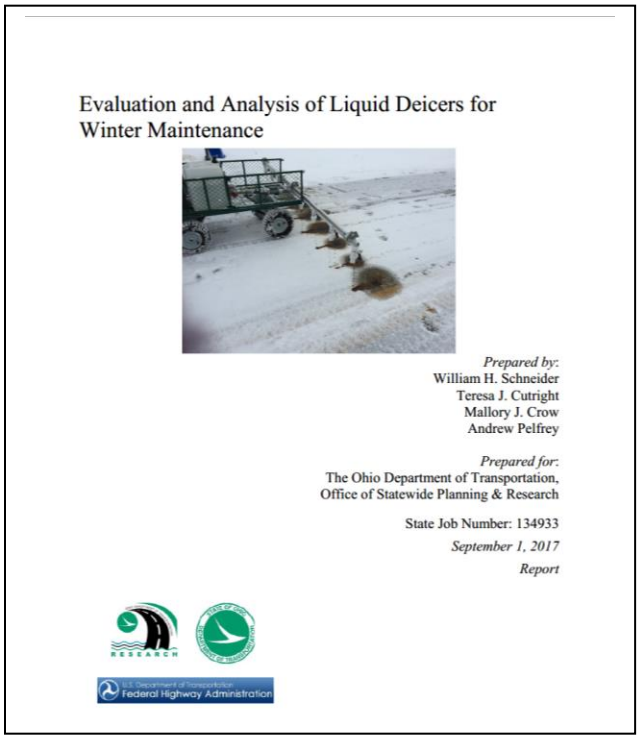
< – indicates a value less than the reported number which is the MDC.

- *There is little potential for members of the public exceeding the public dose limit from exposure to Ra in O&G brine-treated roads.*

  To evaluate potential exposure to the public from the brine-treated roads, a source term of 1 pCi/g of Ra-226 and 0.5 pCi/g of Ra-228 was assumed within a 6-inch layer of surface material (treated road surface). The estimated total dose from 1 pCi/g of Ra-226 and 0.5 pCi/g of Ra-228 above natural background in surface soil, to a recreationist, in the year of maximum exposure (year 1) is 0.441 mrem/yr, which is below the 100 mrem/yr public exposure criteria based on assumed activity concentrations. The actual dose received is dependent upon both the excess Ra radioactivity in surface soil and the time spent exposed to the soil surface. (Section 7.3)

Supplemental Material Supporting SB 171

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

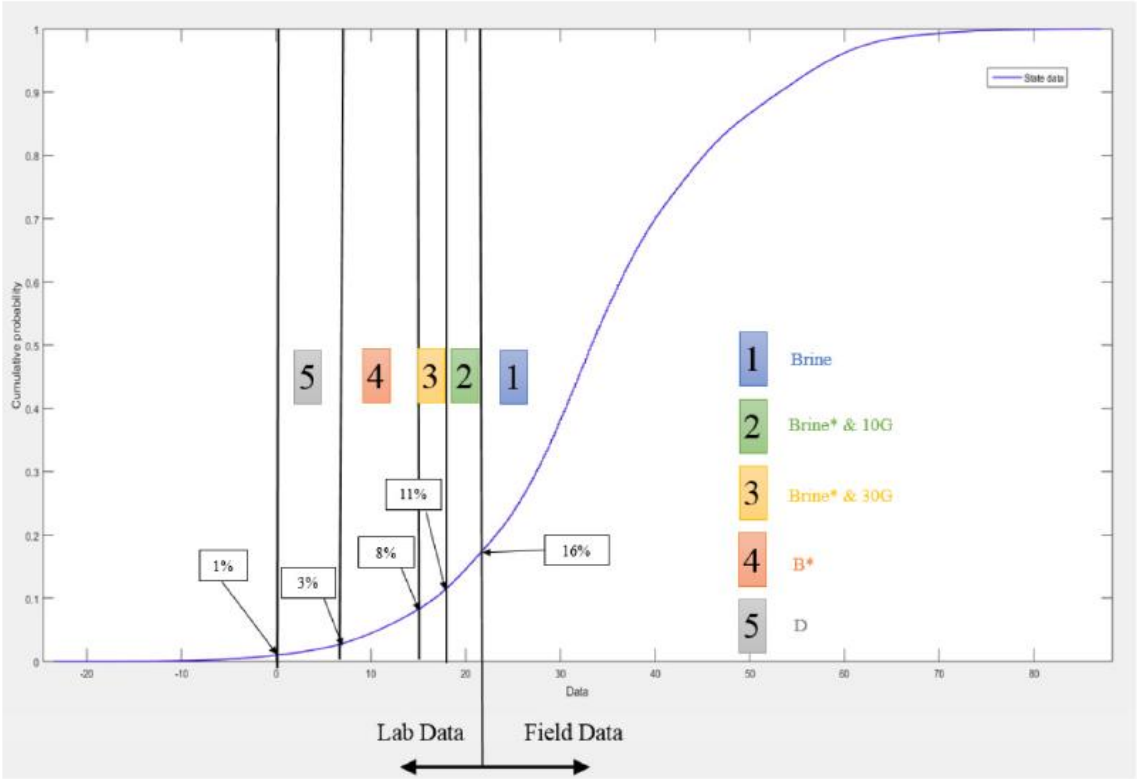
Federal Highway Administration

Deicer Key

- **Deicer A – AquaSalina (AQ)**
- Deicer B – XO Melt 2
- Deicer C – BeetHeet 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 ≥21ºF. Brine performed fair (not good) from 15ºF to 21ºF. **Deicer D** is the best for temperatures between 0ºF to 7.5ºF. Note See Figure 5 and 6 below for more details.

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



Supplemental Material Supporting SB 171

AquaSalina Liquid Deicers vs. Radioactive Food Sources

10 Common Radioactive Foods ~ pCi/kilogram by www.ThoughtCo.com Updated December 24, 2018

Brazil Nuts
6,600 pCi/k

Lima Beans
4,640 pCi/k

Bananas
3,520 pCi/k

Carrots
3,400 pCi/k

White Potatoes
3,400 pCi/k

Low Sodium Table Salt
3,000 pCi/k

Red Meat
3,000 pCi/k

Beer
390 pCi/k

Peanut Butter
0.12 pCi/l

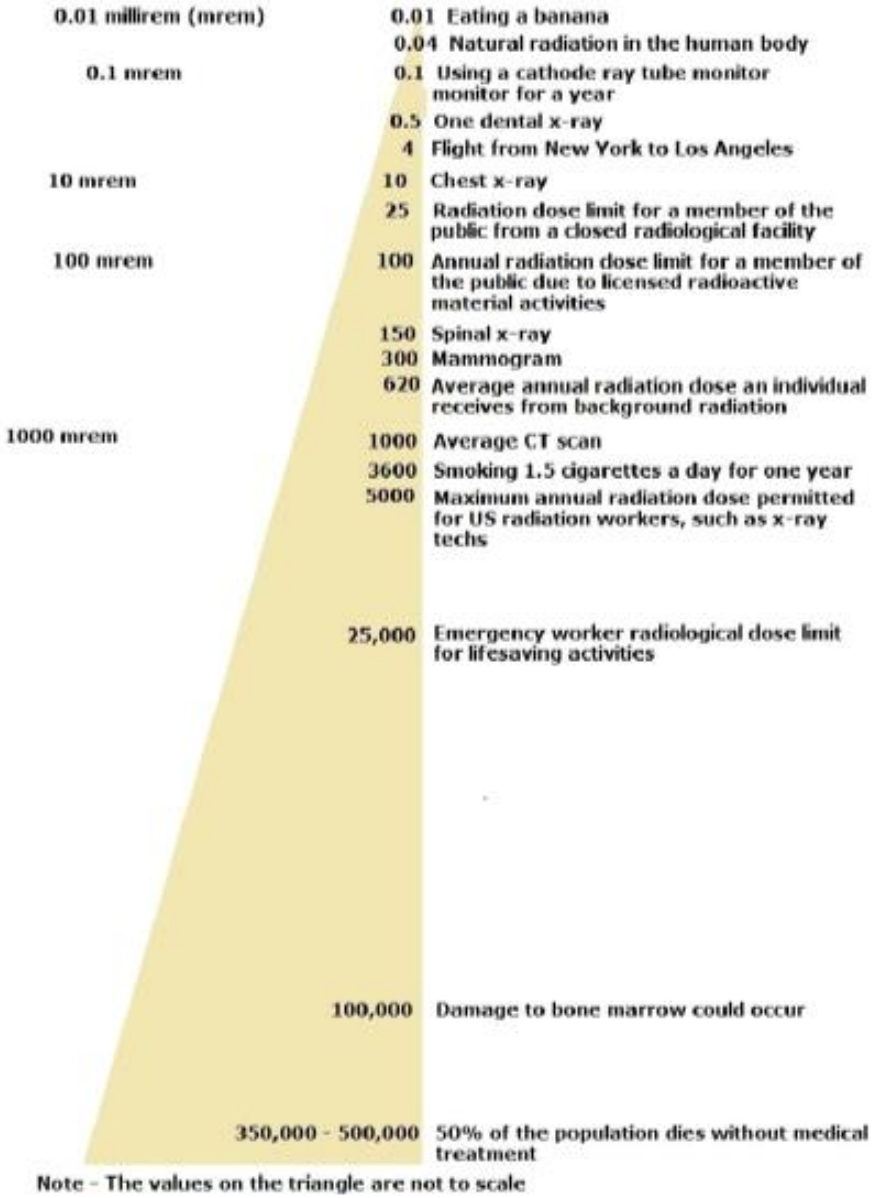
Drinking Water
0.17 pCi/l

AQUASALINA LIQUID DEICERS:

Processed: 1,841-2,365 pCi/l Pace 12/27/2018
Unprocessed: 2,943-3,597 pCi/l Pace 12/31/2018

6. DISCUSSION OF MODELING RESULTS

To put the maximum calculated dose into perspective:



Note - The values on the triangle are not to scale