Idea EXCHANGE

Positive results from dairy salt brine test on winter roads

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IDEAS that improve winter road maintenance and save money are important to highway and street departments in Wisconsin. Add beneficial reuse of existing local materials and the idea becomes a "win-win."

That is Emil Norby's description of a pilot program the Polk County Highway Department conducted in the 2008-2009 winter season to use salt brine from a cheese-making operation as a pre-wetting agent. Norby is Technical Support Manager for the department. The idea about dairy brine emerged that year as Norby investigated alternatives to magnesium (mag) chloride as a de-icer in the county's plowing operations.

"Someone suggested that cheese factories produce their share of wastewater brine," Norby says. "Would that work for roads?"

He contacted F&A Dairy in the Village of Dresser—about 17 miles from Balsam Lake, the county seat—to explore the possibility of using their salt brine for snow and ice control. The dairy manufactures 900,000 lbs of milk per day into cheese. They pay hauling and disposal fees to deal with the waste brine from cheese production. When the county inquired about recycling a portion of that wastewater as a road treatment, F&A was interested.

DNR approval

The company calculated they could supply Polk County with up to 5,000 gallons of salt brine per week, free of charge. They would filter the waste brine to produce a cleaner product. The county planned to send its own trucks to pick up the material from the nearby cheese plant or pay for delivery by a third party.

The dairy agreed to send brine samples to a lab for testing to determine the chemical makeup, including salinity and BOD (biochemical oxygen demand). The tests showed high levels of BOD, which indicates the amount of organic matter in the liquid. So Norby asked the Wisconsin Department of Resources for advice on how to proceed. He learned they needed a Conditional Grant of Low Hazard Exemption Permit from the DNR to use the waste brine on the highways.

F&A requested the permit and the county submitted a proposal for testing the effectiveness of the waste brine on one state road and one county road during the 2008-09 season.

Polk County began the pilot in January 2009 and subsequently received DNR approval to expand it to more roads in the northern half of the county. Norby recorded the salinity of every load of brine, and details about test conditions like road temperature and wind speeds. He included that information with maps and photos in a final report to the DNR on the pilot in April 2009.

Road results

Results from the pilot were positive. The wastewater salt brine proved a beneficial pre-wetting agent for snow and ice control on the test stretches of state and county roads Polk County maintains, saving money and materials.

The standard winter road treatments in this northwestern Wisconsin county are salt on state roads and a salt sand mix for county highways. Operators apply 200 or 400 lbs of salt per lane mile depending on storm intensity and temperatures.

The DNR permit approved using 8 gallons of waste salt brine per ton of salt or sand. It calculated

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Photos taken during the pilot show the results on a county road, left, treated with salt sand only (600 lbs per lane mile) and one with salt sand (400 lbs per lane mile) plus the recycled salt brine, right. Fifteen minutes after application, the salt brine road was 50 percent clearer than the one without the de-icer.

0.8 gallons of pre-wetting liquid per lane mile at the 200-lb per lane mile rate and 1.6 gallons of brine per lane mile at the 400-lb per lane mile rate.

Norby says the department tried mag chloride for pre-wetting before but, due to cost, only as temperatures dropped. Plow drivers put the low-cost dairy brine to work throughout an entire winter season and applied less salt and salt sand overall, saving 30 to 40 percent on those materials. The department also saved about $40,000 by replacing the mag chloride exclusively with the recycled brine.

Besides saving on materials, Norby reported the dairy brine did improve the effectiveness of winter road treatments, much like a brine product specifically made for pre-wetting roads. Surfaces where the county applied salt brine showed measurable improvement over roads where they did not. "Fifteen minutes after a pass combining the salt brine with salt sand on the section of county road we tested, the pavement was 50 percent clearer than on sections treated with salt sand alone," he says. The state route treated with salt saw similar results and quicker reaction time for melting as the brine helped keep the salt on the road.

Norby says the salt-by-weight of brine loads from the cheese factory averaged 24.5 percent during the pilot, giving it a freeze point of 5.95 degrees (F). Salt brine made for the purpose usually is mixed to 23.3 percent by weight with a freeze point of 6 degrees below zero. During the pilot winter, Norby placed a container of the dairy brine outside and found it did not freeze until after two consecutive days when the low temperature reached minus 21.

County crews saw the fastest results with a road temperature of 10 degrees or higher, Norby says. But even at lower temps, the test de-icer helped keep the abrasives from bouncing off the surface.

Low-cost delivery

The department used both a trucking company and its own equipment to haul brine from the cheese factory to storage containers at its shop. Hauling it in their own tanker trucks reduced the cost by 9 or 10 cents per gallon from the 18 cents per gallon charged by the company. Norby compares both to the $1.29 per gallon price the county paid the previous year for delivery of mag chloride.

During the pilot, the county stored the dairy brine in two 6,000-gallon tanks where plow trucks came to fill up before a snow event. They plan to store in tanks at outlying sites as they expand application of the pre-wetting material.

Norby monitored the roads used in the pilot for deposits of salt brine in the spring and found no residue on the pavements test treated during the winter.

During a February snow event with high wind conditions and road temperatures of 18 degrees F, Polk County Highway Department compared results on a county road treated with salt sand (500 lbs per lane mile), left, and another where the plow operator applied salt sand (300 lbs per lane mile) with dairy brine, right. The brine helped the application work better, faster and at lower amounts.

Creating a new source

Norby says the experiment got the attention of plow operators and other technicians in the department when they saw the salt brine in action. They liked how it produced a cleaner, safer pavement for their efforts and they were eager to use it.

Polk County continued using the dairy brine last winter with the same success as the pilot year and plans to apply the recycled material on all state and county roads this season. They will start hauling loads from F&A in October to tanks at the main shop and satellite locations.

The dairy continues to hold the permit allowing use of its wastewater as a de-icing agent. According to Norby, the DNR decided that issuing the permit to F&A would allow other counties, cities and towns to get waste brine from the cheese company for the same purpose. One permit covers multiple local users.

"Working with the dairy and the DNR to see this through was very satisfying," Norby says. "We set out to find a cost-effective way to manage our snow and ice control budget and discovered a solution with wide-spread benefits. It really was a win-win." ■

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Contact

Emil Norby
Polk County Highway Dept.
715-485-8732
emil.norby@co.polk.wi.us

Resource

http://www4.uwm.edu/shwec/

Solid and Hazardous Waste Education Center website with information, education and technical assistance related to beneficial and efficient use of sustainable natural resources in Wisconsin.