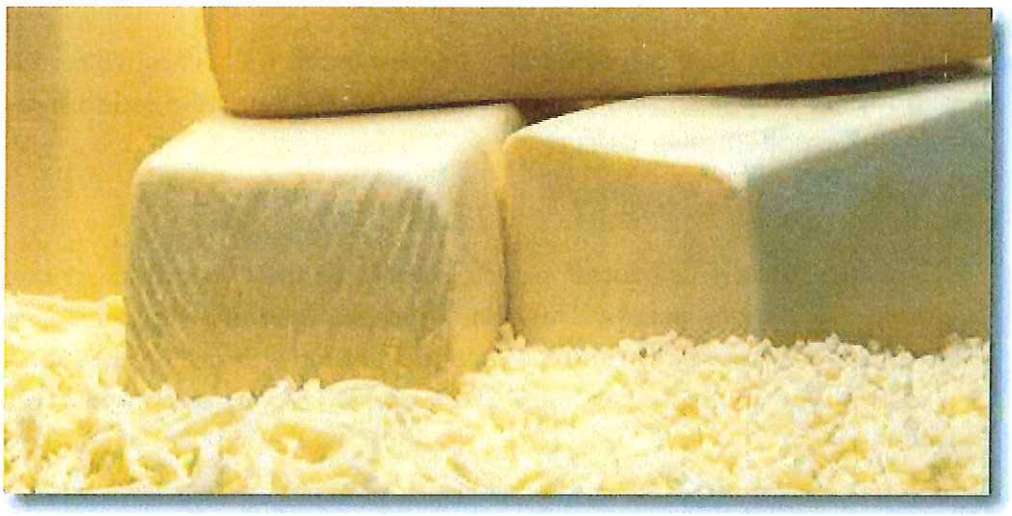
# CHEESE BRINE PILOT



9/15/2014

Follow Up Report on 2013-14 Season

# EXECUTIVE SUMMARY

This is a follow up report to Common Council File #130661 on the feasibility of the Department of Public Works (DPW) using cheese brine as an alternative de-icing agent during the 2013-14 winter season.

DPW obtained 600 gallons of filtered cheese brine from F & A Dairy in Dresser, WI as it was the only cheese manufacturer that was permitted by the Wisconsin Department of Natural Resources (DNR) to allow their cheese brine to be used as an alternative deicing agent on Wisconsin roadways.

Two City salt trucks were recalibrated and designated for use in the pilot. The area selected for the pilot was in the 14th aldermanic district bounded by Kinnickinnic Avenue, S Shore Drive, E Lincoln Av and E Oklahoma Av. Alderman Tony Zielinski led the charge to test this product.

There was much media fanfare and interest in this new, unconventional use of a waste byproduct and reporters called from as far as Canada and Australia to learn how we were using cheese brine as an alternative deicer.

The cheese brine was housed in saddle tanks on the two salt trucks and applied as the rock salt was spread on city streets. The brine used per lane mile varied based on the prescribed salt spread rate for each storm but averaged around 2.5 gallons per lane mile. The cheese brine was depleted by early February 2014 and DPW was unable to acquire more for the rest of the winter.

Initial results showed that the salt pre-wet with brine activated faster, remained in the driving lane better than dry salt and kept the pavement clear a little longer. There was no apparent odor or unusual residue observed after application.

Based on the test results, DPW has concluded that pre-wetting salt with liquid brine is beneficial and should result in overall reduced salt usage. To that end, DPW has requested funding in the 2015 capital budget to purchase equipment to produce and store salt brine for use in winter operations.

# CHEESE BRINE PILOT

## PREPARATION FOR USE

DPW Fleet Operations Manager Jeff Tews researched the requirements for using cheese brine as an alternative de-icing agent on Milwaukee streets and learned that as a food waste by-product, cheese brine is regulated by Wisconsin Department of Natural Resources (DNR).

According to DNR representative Ken Hein, the cheese maker supplying the brine is required to hold a Wisconsin Pollutant Discharge Elimination System wastewater discharge permit, or WPDES. The permit costs $550 and allows for an exception for a waste product to be used for beneficial purposes, but requires the cheese manufacturer to maintain strict control of the waste product prior to release to an end user. The cheese brine product must adhere to the following values:

1. Biochemical Oxygen Demand (BOD) levels cannot exceed 20,000 mg/liter, with an optimum range of 6,000 – 8,000. According to the Environmental Protection Agency (EPA), BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. The consequences of high BOD are the same as those for low dissolved oxygen: aquatic organisms become stressed, suffocate, and die. Sources of BOD include leaves and woody debris; dead plants and animals; manure; effluents from pulp and paper mills, wastewater treatment plants, feedlots, and food-processing plants; failing septic systems; and urban storm water runoff.

2. Protein Total Kjendahl Nitrogen (TKN) must be <0.1%. This is after filtering the brine to remove a majority of the fats and greases found in cheese brine.

3. The permit holder must maintain a log with the measured values of the cheese brine BOD's and TKN's as part of holding the permit.

Unlike salt brine manufactured from salt and water, cheese brine cannot be discharged directly onto streets so it cannot be used in the City's three brine trucks. For salting streets, the use of cheese brine is limited to a pre-treat rate of 15 gallons of brine for every one ton of salt used. A hopper typically holds 7-8 cubic yards of salt, each weighing about 1 ton per cubic yard, which further restricts the application of cheese brine to 120 gallons for each load of salt dispersed.

Cheese brine from the manufacture of mozzarella and provolone cheese is ideal due to the salinity being close to the ideal range of 23.3%. Very few cheese plants in Wisconsin manufacture enough of these cheese types to generate a substantial amount of waste cheese brine.

## ACQUISITION AND SETUP

DPW obtained 660 gallons of mozzarella cheese brine from F & A Dairy Products in Dresser, WI in November 2013. The product was free of charge, but had to be transported 330 miles one way from Dresser, WI. The driver, truck, fuel, and container rental cost was $1,475 for a net cost of $2.23 per gallon of cheese brine. Regular salt brine costs around $0.15 per gallon.

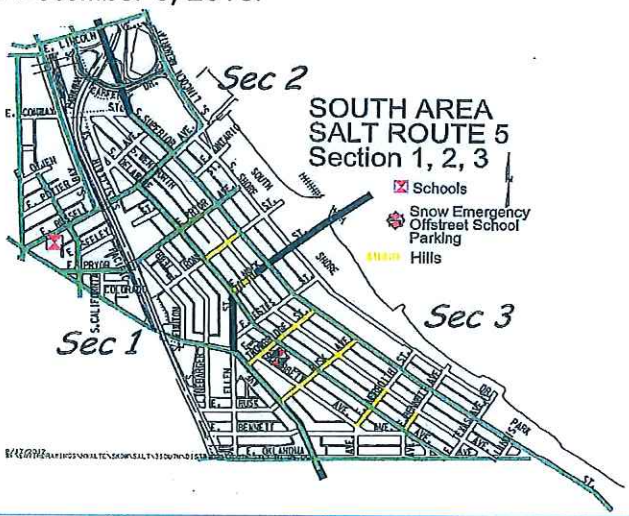
Since the application rate of cheese brine is limited to15 gallons per ton of salt, the settings on the two test trucks used for this project were modified to correspond with WDNR permit limits as follows:

| Salt | | |
|---|---|---|
| **Per Mile** | Miles per ton | Cheese Brine rate/max. |
| **200 lbs.** | 10.8 miles | 1.3 gallons lane/mile |
| **300 lbs.** | 7.2 miles | 2.1 gallons lane/mile |
| **400 lbs.** | 5.4 miles | 2.8 gallons lane/mile |
| **500 lbs.** | 4.3 miles | 3.5 gallons lane/mile |

When the initial supply of cheese brine was exhausted in early February 2014, F & A Dairy Products was contacted for another load, but had no more cheese brine available. They stated that more cheese brine might be available by the end of February, but would be given away on a first-come, first-serve basis. No additional cheese brine could be obtained for the remainder of the winter season.

## PILOT AREA AND RESULTS

The Department selected a roughly 50 lane mile pilot route in the 14th aldermanic district bounded by South Shore Drive and S Kinnickinnic Avenue between E Lincoln Avenue and E Oklahoma Avenue and began testing the product on December 8, 2013.



DPW staff observed the pilot area and documented road conditions before, during and after the roads were treated with salt pre-wet with cheese brine. (See sample observation log below)

**CHEESE BRINE**
**OBSERVATION LOG**

DATE: December 14, 2013

| ROUTE | TEAM (A/B) | TRUCK # | TIME | TYPE OF OPERATION | TYPE/AMOUNT OF PRECIPITATION | TIME BETWEEN RE-APPLICATION | TEMPERATURE | PAVEMENT RESIDUE/ ODOR | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| 5 | B | 25333 | 9:30am | G I C | Flurries - about 1/2" | 1st Appl | 27° F | None / No Odor | Driver: Joel Johnson - Ostricki East Lincoln Ave Bridge and E Russell Ave. |
| 5 | B | 25333 | 10:30 | G I C | Flurries - about 3/4" total accumulation | 1st Appl | 27° F | None / No Odor | S Superior St. and S Delaware Ave. |
| 5 | A | 25333 | 12:30pm | G I C | Slight flurries, | 2nd Appl | 27° F | None / No Odor | Driver: M. Cintron S Superior St. and S Delaware Ave. |
| 5 | A | 25333 | 1:30 | G I C | Slight flurries, | 2nd Appl | 27° F | None / No Odor | East Lincoln Ave Bridge and E Bay St. |
| 5 | A | 25333 | 2:30 | G I C | Flurries - stopped. About 1" total accumulation | 2nd Appl | 27° F | None / No Odor | East Lincoln Ave Bridge and E Bay St. Started using underbelly plow |
| | | | | | | | | | Final comment: Pavement turned from 1/2" snow cover to wet pavement in approx. 20 minutes, with traffic. |

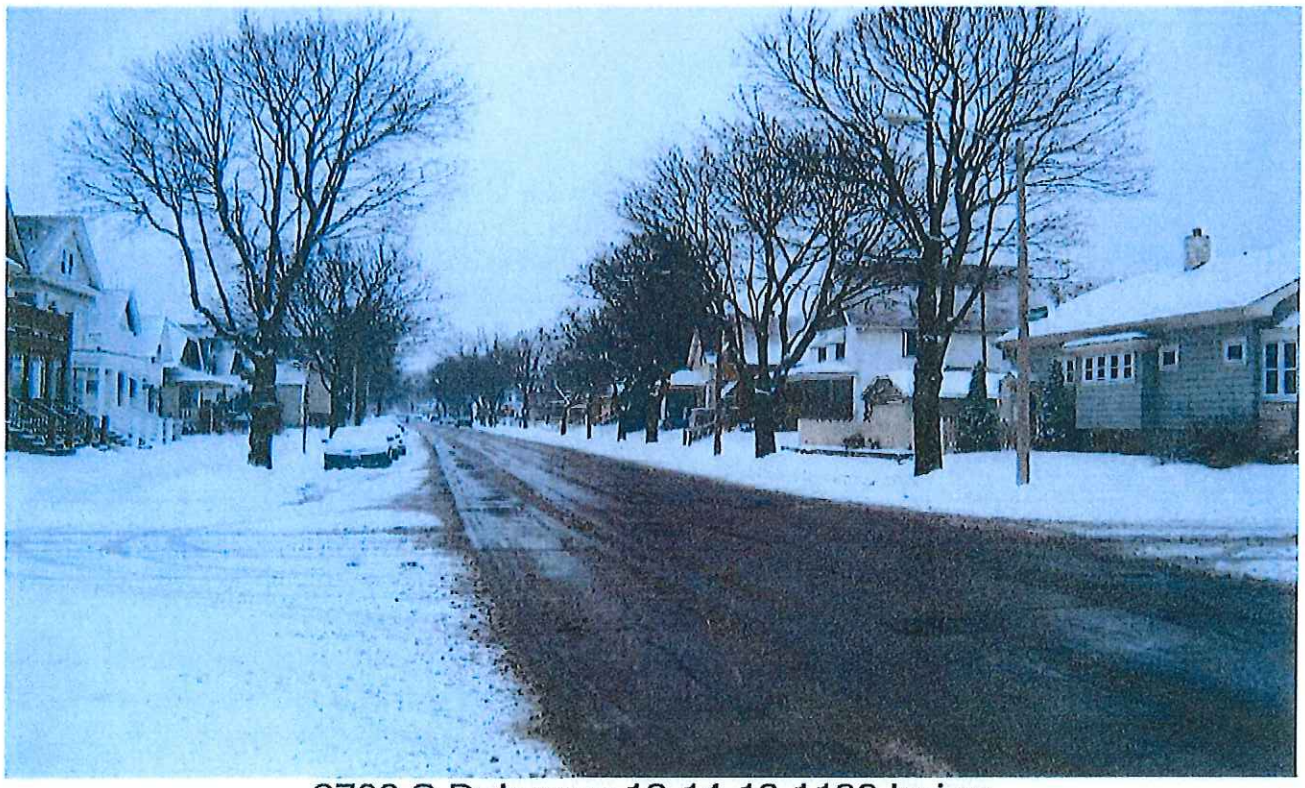
There was initial concern of potential odor or residue from the cheese brine, which proved unwarranted. Additionally, concern was voiced regarding potential effects on people with dairy allergies and whether the intermittent use of this product on roadways would cause allergic reactions. The Milwaukee Health Department Disease Control and Environmental Health Division provided assurance that they saw no significant health risk related to inhalation of vapors or inadvertent short-term skin contact associated with the rock salt/cheese brine mixture.

The pilot results did show that the salt pre-wet with brine:

- activated faster
- remained in the driving lane better than dry salt (due to reduced bounce and scatter of salt)
- kept the pavement clear a little longer

There was no apparent odor or unusual residue observed after application of salt pre-wet with cheese brine. It was estimated that the pilot would cost around $6,500. The final cost of the pilot was $3,135 which includes for staff observation time during storms and documentation of test results.


2700 S Delaware 12-14-13 1052 hr.jpg



2700 S Delaware 12-14-13 1130 hr.jpg

2100 S Bay St - bridge Eastbound 12-14-13 1107 hr.jpg

2100 S Bay St - bridge Eastbound 12-14-13 1300 hr.jpg

## CONCLUSION

The cheese brine pilot did provide valuable information on the benefits of pre-wetting salt with some type of liquid activator, be it salt brine, liquid calcium chloride or other liquid deicing product versus using dry rock salt.

As a result, the Department has requested funding in the 2015 capital budget to purchase equipment to produce and store its own salt brine for use in winter deicing operations. Additionally, the Department was able to bid on and win at auction a used salt brine maker from the City of Beloit, WI. It is anticipated that the used brine maker will be operational later in the 2014-15 winter season.

The Department has not obtained additional cheese brine for this upcoming winter season due to lack of availability and the per gallon cost from transporting the brine. However, it was discovered that two additional cheese manufacturers have been permitted by the DNR for their cheese brine to be used as an alternative de-icing agent: Burnett Dairy Cooperative in Grantsburg, WI and Grande Cheese Company in Juda, WI.

The addition of using salt brine as a pre-wet agent in the City's snow & ice control operations arsenal should reap the benefits of faster activation of salt spread on roadways and reduced salt usage due to more salt staying in the driving lanes versus dry salt bouncing and scattering to the medians or curbs.

Report Drafted by:

Wanda Booker, Sanitation Services Manager