



## Road Salt Comparison Review

**Date of Review:** February 11<sup>th</sup> 2009

**Location:** Highway 93 north Whitefish, MT

**Reviewer:** Justun Juelfs and Mike Miller

**Introduction:** Historically MDT has relied on sand or a blend of salt/sand plus liquid chemicals like magnesium chloride brine to assist with our winter maintenance operations. Due to increased level of service demands and negative environmental impacts associated with the use of sand, MDT's winter maintenance program continues to evolve. In the last several years the Kalispell division has supplemented their program with the ability to apply solid salt at reduced application rates.

To ensure consistency, environmental sensitivity, and superior performance are integrated into the chemicals available for winter maintenance, the Pacific Northwest Snowfighters (PNS) group was formed.

The Pacific Northwest Snowfighters have sorted winter maintenance chemicals with similar properties and performance characteristics into categories. Currently there are nine categories that make up the Qualified Products List (QPL). Category 8 identifies non corrosion inhibited solid sodium chloride (road salt) products. Category 8 is broken into several sub-categories that isolate gradation and moisture content. Presently there are over 20 different products that make up Category 8. Traditionally MDT has only accepted bids for products that were listed on the QPL. Products within the same category are considered similar; therefore the price determines which product to purchase.

Recent feedback from MDT operators indicated increased performance from Ice Slicer RS manufactured by Redmond Minerals, over the current white salt product Bulk Type C Road Salt manufactured by Morton Salt, both products are listed in Category 8. To facilitate field performance distinction between the two products and justify purchasing one product over another, several side-by-side field comparisons have been implemented. For research purposes, a limited amount of Ice Slicer RS was negotiated at a reduced purchase price to accommodate the comparisons.

Purchasing a product with superior performance at an elevated cost may be in the best interest of the Department, if increased level of service, lower application rates or less environmental loading is taken into consideration.

**Comparison Parameters:** On January 28<sup>th</sup> 2009 a meeting was held in the Kalispell conference room to lay the ground work for the proposed Ice Slicer/White salt performance comparisons. The Kalispell Maintenance Chief, Maintenance Superintendents, Section Supervisors, Maintenance Technicians, Helena Maintenance Review along with two Redmond Mineral representatives and one Desert Mountain representative attended. As a result of the meeting the following parameters were identified.

- Location of the initial comparison
  - Approximately 5 miles of Hwy 93 north (N5).
    - MP 122 -127.
    - North and South bound lanes.
    - 11 reference points have been identified.
- Conditions
  - Less than 20 f surface/greater than 0 f surface.
  - Snow event with wind speeds less than 15 mph that would typically prescribe solid chemical treatment.
  - Rich Sipe, Maintenance Superintendent and/or Wade Toren, Whitefish Section Supervisor will relay relevant weather forecast information to Maintenance Review so they can be onsite for the comparison.
- Application rates
  - 200 #s per lane mile with equal pre-wet.
- Calibration verification
  - The Kalispell shop will calibrate two like trucks to the prescribed application rate.
- Performance measurement
  - Photos at 11 reference points will be taken at each location throughout the storm event until the integrity of the test is compromised due to cross contamination.
  - Documentation will be recorded on the attached spreadsheet.
- Additional comparison locations will be based on storm events meeting the criteria listed above. The Whitefish and Libby sections currently have Ice Slicer and white salt on hand.
- Conclusion
  - Information will be consolidated by Maintenance Review staff and put into report form with future recommendations.
  - All documentation will be made available to Dave Wilkening from Redmond Minerals.

## Comparison # 1

**Observations:** At approximately 6:00 am light snow started to fall. By 7:00 am Highway 93 north from the Junction of MT 40 and the north end of the test section was starting to become snow covered. Due to the slower traffic speeds through the town of Whitefish and the several stoplights through the test section, the light snow had began to pack in the wheel tracks causing scattered icy conditions. After assessing the conditions and the forecast a decision was made to limit the test section to approximately 1.5 miles through the town of Whitefish. The remaining portion of the proposed test section was still blowing bare.

Due to limiting the test section, only four reference points instead of 11 would be documented through out the comparison. The reference points are listed below.

1. Jct US 93 & MT 40----- 125.42
2. JP Road----- 125.91 (light)
3. 19<sup>th</sup> Street(Sportsman Ski Haus)----- 126.5
4. 13<sup>th</sup> Street (Town Pump)----- Intersection (light)

Each reference point was documented and recorded individually throughout the storm event on the form below.

Kalispell Division White salt vs. Ice Slicer (RS) comparison 2009											Date _____	
Route _____		Reference Point _____			Material Rate _____		Pre-wet Rate _____		Mag Brine	Speed _____		
Application Time/Temp	Check Time	Material	Road Temp	Air Temp	Direction	Traffic		Lane	Traffic	Photo Number	Road Cond.	Results
		RS			North	Lt.	Mod	Driving	L / M / H			
		Salt			East	Hvy		Passing	L / M / H			
		RS			South	Lt.	Mod	Driving	L / M / H			
		Salt			West	Hvy		Passing	L / M / H			
Comments _____												
_____												
_____												

From 7:52 am – 8:01 am pre-application photos were taken at all four reference points both north bound and south bound. The pavement temperature ranged from 19 – 20 F.



**Figure 1 Pre-application photo**

Truck # 29-0398 was loaded with Ice Slicer RS and calibrated at 200 #s per lane mile with 30 gallons per ton salt brine pre-wet and truck # 29-0333 was loaded with white salt and calibrated at 200 #s per ton with 30 gallons per ton salt brine pre-wet. Although both trucks were calibrated to apply the same application rates, the gate opening were different. 29-0398 was measured at 2 ½” and 29-0333 at 1 ½” opening. Typically more uniform applications are observed with higher chain speeds and lower gate openings.

The salt was applied at a rate of 200 #s per lane mile pre-wet with corrosion inhibited salt brine at a rate of 30 gallons per ton. The northbound application started from the junction of MT 40 and Highway 93 north and continued north to the end of the four lane approximately 1.5 miles. Ice Slicer RS was applied on the outside lane and white salt was applied on the inside lane.

The trucks switched lanes for the southbound application, Ice slicer RS was applied on the inside lane and white salt applied on the outside lane from the end of the four lane south to the junction of MT 40 and Highway 93 north.

The same application rate was applied in both directions. The application took approximately 8 minutes from 8:02 am – 8:10 am. The surface temperature ranged from 16 – 20 F and the ambient temperature from 23-24.

The trucks held a 30 mile per hour application speed with the exception of several stop lights. Both of the trucks had removed their spinners in an attempt to consolidate the chemical.

When following the trucks during the application the Ice Slicer was more visible due to its reddish color and the white salt seemed to bounce and scatter more than the Ice Slicer.



**Figure 2 Ice Slicer in the near lane, white salt in the far lane**

Monitoring though out the storm event continued for approximately 2 hours after application. There was a noticeable difference in the action on the road; the Ice Slicer had more of a continuous ribbon of bare and wet, the white salt was blotchy and required traffic to tie things together. With that said, both products provided acceptable levels of service within 30 minutes of application.

This storm event was inadequate to determine conclusive evidence of strong performance differences between the two products, both products had satisfactory performance.



**Figure 3 Ice Slicer in the near lane, white salt in the far lane. Notice the consistent ribbon effect in the near lane.**

## **Comparison # 2**

On February 26<sup>th</sup> 2009 a comparison between Ice Slicer RS and white salt was implemented on the West Glacier section. The Ice Slicer application was provided by Whitefish FMS and the white salt application was provided by the West Glacier FMS. Oversight and photo documentation was provided by the Maintenance Superintendent.

Prior to the application the West Glacier section had received approximately 6" of snow fall. The road had been continuously plowed during the event to remove as much overburden as possible but no chemical applications were made prior to the comparison.



**Prior to application**

**Observations:** The comparison started with snow packed and icy conditions. The ambient temperature ranged from 10 -21 F and the surface temperature ranged from 16 – 20 F. Both trucks were calibrated to apply 200#s per lane mile and equipped with pre-wet mixing chambers to saturate the material prior to application. Both products were pre-wet with salt brine.



**10 minutes after application**



**30 minutes after application**



**1 hour after application**



**2 hours after application**

This comparison was implemented on Hwy 2 between West and East Glacier. Due to working with a two lane road, a side by side comparison was not able to be conducted. As an alternative, the materials were separated by direction of travel. Traffic plays a major role in material performance by getting the snow and chemical to mingle as well as continuing to spread it, through tracking. There was no specific traffic measurement done within the test area, although the crew performing the test classified it as light in both directions.

General feedback from the operators and the Maintenance Superintendent is that the Ice Slicer worked quicker and lasted longer than the white salt application. The Ice Slicer application areas allowed the crew to establish bare road sooner than with the white salt applications. As noted in the initial Whitefish test, the reddish color of the Ice Slicer helped to reassure the operators that adequate application had been made. In the case of the white salt application it was difficult at best to see on the snow packed road, leaving the operators uncomfortable with the anticipated effectiveness of the initial application.

**Conclusion:** Although both products are listed in the same category there are differences between the two. The most apparent is the color; it's an advantage for MDT and our customers to be able so see the initial results of a treatment. The Ice Slicer is more visible to a snow covered road than white salt. The visual perception is reassuring for our customers and helps our operators recognize where treatments have already been placed.

Gradation is also different between the two products, although they pass the same specification. The Ice Slicer tends to have a wider range of particle size than the white salt. This could provide a performance advantage because the fine particles would go into solution sooner than the larger particles and the large particles would provide longer lasting protection, provided they stay in place until they go into solution. Traffic count and speed greatly impact the retention of product on the road surface.

White Salt

Gradation	
Screen Size	PCT Passing
3/4	100
4M	92
8M	49
30M	1.7

Ice Slicer RS

Gradation	
Screen Size	PCT Passing
3/4	100
4M	79
8M	61
30M	14.8

Moisture	
% Moisture	
% Moisture	0.30%

Moisture	
% Moisture	
% Moisture	2.40%

Insoluble's	
% Insols	
% Insols	0.68%

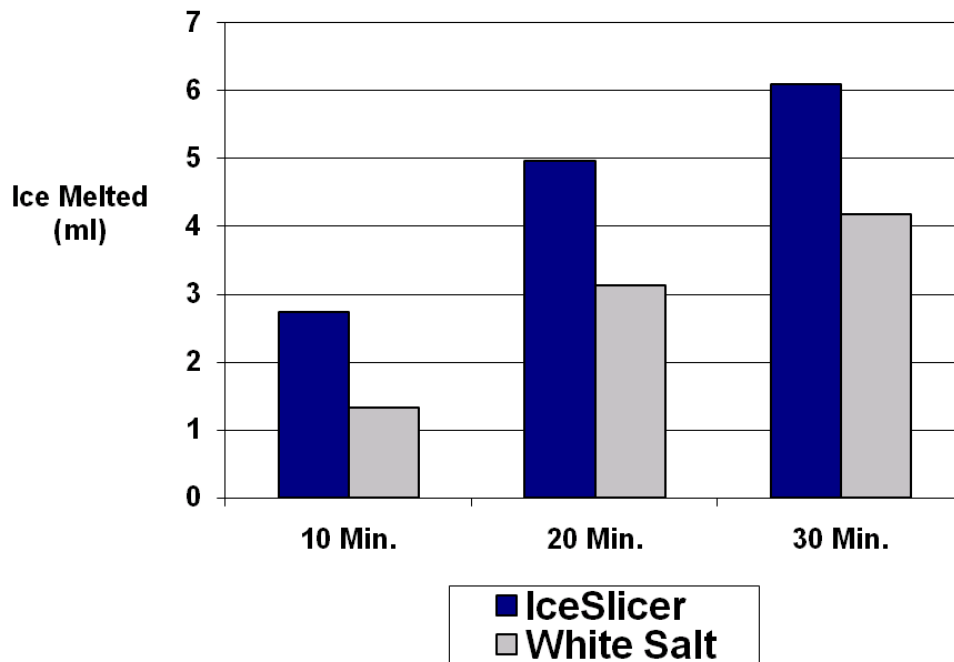
Insoluble's	
% Insols	
% Insols	7.47%

Corrosions	
PNS #	
PNS #	92.50%

Corrosions	
PNS#	
PNS#	79.90%

Corrosion protection is also slightly different between the two products. The Ice Slicer is 20.1% less corrosive than reagent grade salt on mild steel and the white salt is 7.5% less corrosive than reagent grade salt on mild steel. The current Montana specification for corrosion protection 75% less than. Although neither of the products meets the current specification, value added could be applied to the product with the higher corrosion protection. In this case, that would be the Ice Slicer RS with 12.6% greater corrosion protection on mild steel.

The following diagram was provided by Redmond Minerals, however the data used to create the chart was provided by an independent laboratory from Michigan Technological University. The chart displays ice penetration at 15 F.



## **Recommendations:**

- Draft Sole Source Justification for Ice Slicer RS based on increased performance advantages outlined in this review.
  - 30 – 50 % material usage reductions may be realized when using Ice Slicer over white salt. Consider authorizing its purchase if its delivered price is < 130% of the delivered price of white salt.
- Meet with the Pacific Northwest Snowfighters and discuss the possibility of creating a specific category for products with similar performance properties.
  - Broad gradation range.
  - Melting effectiveness over time and temperature.
- Explore gradation penalties for materials out of specification. Consider only assessing penalties for materials that fail to store or distribute properly.
- Store all solid chemical under cover to avoid leaching and loss of investment.
- Consider early ordering to avoid fall congestion and potential delays in product delivery.
- Meet with MDT purchasing agent prior to FY 2010 ordering to ensure the “Sole Source Justification” meets MDT purchasing policy.