Deicer Performance Review – Corrosion

Understand the Science – Avoid Deceptive Claims

Introduction
The deicer corrosion issue is quite complex, involving many different facets and variables. For trusting individuals, a lack of recognition of the these complexities may lead to acceptance of performance claims without question. However, when one uses good science to evaluate the data used to support a claim, it is often easy to find significant gaps, or even cases of deliberate deception.

The Big Picture
In an attempt to assess the status of the corrosion issue in the real world, it is helpful to look at the big picture by checking reports from different sources and locations.

"Oxidized paint, corroded chrome, chewed up wiring, pitted aluminum parts - Rick Duran has seen it all come through Rush Tracking Centers of Colorado."
The Denver Business Journal, April 1999

"Fleets that have been exposed to mag chloride report that their wiring systems are deteriorating at an alarming rate."
Newport's Heavy Duty Trucking, October 2001

"Absolutely there is corrosion associated with mag chloride and sodium chloride, calcium chloride, potassium chloride. There is association with non-chlorides as well."
Magnesium Chloride on Roads, Dan Williams, MT DOT, The Board of Montana Flathead County Commissioners meeting, February 2003

"This evaluation indicates that the use of corrosion-inhibited chemicals is not resulting in the levels of reduced corrosion for which these chemicals are specified, tested, and purchased."
2002-03 Salt Pilot Project, WA DOT, August 2003

Unfortunately, it appears that corrosion associated with deicer usage is still a significant issue, despite widespread use of corrosion-inhibited products.

A Glimpse into the Complexity of Corrosion

To better understand vendor performance claims, literature articles and technical reports associated with the deicer corrosion issue, it is important to have a basic understanding of the complex interaction of variables that ultimately determines corrosion performance.

There are many different types of corrosion, including uniform, pitting, crevice, filiform, galvanic, intergranular, exfoliation and biological.

Environmental factors that influence corrosion include temperature, humidity, oxygen level and fluid movement.

There are many chemical factors that influence corrosion rate, including composition, pH and trace impurities. For example, ppm levels of copper can dramatically increase aluminum corrosion.

There are many different types of metals and metal alloys. Each is likely to behave differently in a specific corrosive environment.

There are different test methods used to measure corrosion. Different methods are likely to give different, sometimes conflicting, results.

Inhibitor performance can vary greatly on different metals and thus inhibitor rankings based on one metal are not universal. Even very small differences in metal chemistry can make major differences in inhibitor performance.

These are a few of the complexities associated with corrosion science. There are more, but the point is made. Corrosion is a difficult nut to crack. However, a few rules of thumb can help minimize the chance of falling victim to misleading claims. Refer to the back page for more on this topic.

Rules of Thumb for Assessing Comparative Data

Rule #1: Product composition must be clearly specified. Concentration is a key variable in the measurement of corrosion. By specifying the concentrations of CaCl2 and MgCl2 in Table 1, the credibility of the data is enhanced. However, that credibility is hurt by showing 38% CaCl2 as a "Deicing Fluid", because this product is not used in deicing applications. The comparison with 38% CaCl2 is irrelevant and misleading in the context presented.

Rule #2: Blanket claims are often cover-ups. Data comparisons similar to that in Table 2 have been in circulation for years, and used by some as a basis for a "less corrosive than CaCl2" blanket claim. There are two major problems with this. First, it is easy to see that Table 2 was created by "massaging" the data from Table 1 to hide the fact that the comparison is between products of significantly different concentration. Second, with a complex issue like corrosion, it is utterly ridiculous to base a "less corrosive" blanket claim on one test result, from one test method on one type of metal.

Rule #3: Lab results may not reflect real world results. The correlation between the lab testing and the field results must be proven, not assumed. In Washington State, efforts have been underway to correlate PNS Corrosion Test results with field results. Thus far, the correlation hasn't been very good, particularly in the case of aluminum, (see Figure 1).

Rule #4: Always crosscheck with data from other sources. In 2002, Colorado DOT published a corrosion study which evaluated the effects of MgCl2 and NaCl on metals commonly used in automobiles. Using a test method validated to correlate well with real world performance, (SAE J2334), two surprising results were obtained relative to performance claims, (see Figure 2). First, MgCl2 was found to be more corrosive than NaCl on the aluminum and stainless steel alloys tested. Second, corrosion- inhibited MgCl2 was significantly more corrosive to SS 410 alloy than uninhibited, reagent grade MgCl2.

Dow's Position: The jury is still out on inhibited deicers.

Tough questions have come up in recent years with regard to the performance of corrosion-inhibited deicers. Have corrosion-inhibited products reduced corrosion on some metals while worsening corrosion on others? What test method best represents real world performance? To help find answers to these and other questions, Dow's Calcium Chloride business pledges to support industry efforts to better understand the corrosion issue and to determine which corrosion test methodology best represents real world performance.

Table 1. Data comparison taken from current product literature*

Metal Corrosion Tendency

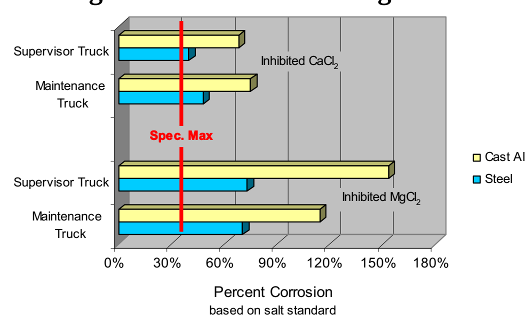
Deicing Fluid	PNSDOT Relative Corrosion Rate
Distilled Water	0
Rock Salt (NaCl)	100
Calcium Chloride ($CaCl_2$) 38%	126
Calcium Chloride ($CaCl_2$) 30%	86
Magnesium Chloride ($MgCl_2$) 30%	80
Product X	13.85

Table 2. Example of intentionally deceptive data comparison

Metal Corrosion Tendency

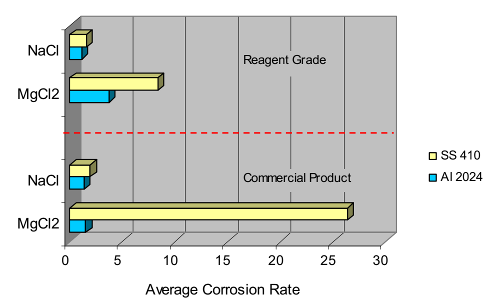
Deicing Fluid	PNSDOT Relative Corrosion Rate
Distilled Water	0
Rock Salt (NaCl)	100
Calcium Chloride ($CaCl_2$)	126
Magnesium Chloride ($MgCl_2$)	80

Figure 1. 2002-03 Field Corrosion Testing Results Washington State Salt Pilot Program*



*Baroga, Enrico, "Washington State Department of Transportation 2002-03 Salt Pilot Project," August 2003

Figure 2. Colorado DOT Corrosion Testing Results SAE J2334 Test Method



*Xi, Yunping and Xie, Zhaohui., "Corrosive Effects of Magnesium Chloride and Sodium Chloride on Automobile Components," Report No. CDOT-DTD-R-2002-4, Colorado DOT Research, May 2005

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