Submitted to the Transportation Research Board (TRB) for Presentation at the 6th International Symposium on Snow Removal and Ice Control Technology in June 2004

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
2002-03 SALT PILOT PROJECT
August 2003

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Submitted on November 12, 2003
Word Count: 4720

ABSTRACT: During the winter of 2002-03, the Washington State Department of Transportation (WSDOT) conducted a field evaluation that compared several aspects of using sodium chloride for highway snow and ice control and corrosion-inhibited snow and ice control chemicals. Sections of highway were designated in which salt products (salt brine and rock salt) were the sole chemicals used. Similar sections of highway were

designated in which corrosion-inhibited chemicals (corrosion-inhibited liquid calcium chloride, corrosion-inhibited liquid magnesium chloride, and corrosion-inhibited rock salt) were the sole chemicals used.

The cost of materials, equipment, and labor for sections in which salt was used was significantly less than like costs for those sections in which corrosion-inhibited chemicals were used. The results, in terms of average roadway condition during inclement winter weather, were similar between highway sections where salt was used and highway sections where corrosion-inhibited chemicals were used.

The corrosion evaluation provided varied results based on different scenarios. Corrosion was evaluated by exposing samples of steel, sheet aluminum, and cast aluminum to either salt or corrosion-inhibited chemicals and comparing corrosion rates on them. Exposure of the metal samples was accomplished by attaching them to maintenance trucks, maintenance Supervisor pick-up trucks, and roadside guardrail posts. The basis to which the corrosion results are compared is a performance specification used by WSDOT and several other road maintenance organizations. WSDOT specifies that corrosion-inhibited chemicals must be at least 70 percent less corrosive than salt. A laboratory test that simulates environmental exposure to snow and ice control chemicals has traditionally been used to verify whether or not chemicals meet this specification. Steel is typically the metal of choice in conducting this lab test. The corrosion-inhibited chemicals generally come close to, meet, or exceed the 70 percent specification when tested on steel using the laboratory analysis. Use of the corrosion-inhibited chemicals in the field evaluation did not meet the 70 percent specification in any comparison scenarios. In some scenarios, the use of corrosion-inhibited chemicals resulted in some reductions in corrosion and in other scenarios; their use resulted in more corrosion compared to the use of salt.

In the environmental evaluation, chloride levels found in roadside soils, surface water, and underlying groundwater were found to be generally low and well below any applicable regulatory standards or guidelines. No pattern was evident from this evaluation of increased contribution of chlorides to the roadside environment dependent on whether salt was used or corrosion-inhibited chemicals were used.

BACKGROUND AND RESEARCH OBJECTIVES: The Washington State Department of Transportation (WSDOT) discontinued the use of rock salt in the late 1980's in favor of alternative, corrosion-inhibited chemicals. In the years since this policy change, WSDOT personnel have noticed continued corrosion on maintenance trucks and have received complaints from road users regarding corrosion. On the other hand, WSDOT Bridge personnel have noticed a general decrease in the amount of rehabilitation work needed on bridge decks due to corrosion in the underlying rebar. This conflicting information has caused WSDOT maintenance personnel to raise the question of how much reduction in corrosion is actually occurring in the roadway environment from the use of corrosion-inhibited chemicals compared to the use of salt. The only documentation of relative corrosion rates from exposure to sodium chloride and corrosion-inhibited chemicals under like circumstances has been from tests conducted under controlled, laboratory conditions. It seemed plausible that differences between the controlled laboratory environment and the variable roadway environment might lead to different rates of relative corrosion.

In addition to the questions about corrosion from snow and ice control chemicals, it was felt that an overall evaluation of sodium chloride as a highway maintenance tool in Washington State was needed. Factors that led to this include sodium chloride's cost-effectiveness, changing anti-icing chemical application practices, other road maintenance organizations' extensive, continued use of sodium chloride, and improved corrosion protection practices in the truck and automobile manufacturing industry as well as in bridge construction. The use of liquid anti-icers (i.e. salt brine) in a preventive manner results in much lower levels of chlorides being applied to the roadway. Application of chloride much lower levels of chlorides being applied to the roadway. Application of chloride-based liquids typically equates to approximately 100 pounds of salt, or chlorides, per lane mile. Contemporary application rates for solid chemicals (i.e. rocksalt)), when used for accumulated snow or compact snow and ice, are typically between 200 and 300 pounds per lane mile.

<u>Research Objectives:</u> The general objective of this research project was to carry out a multi-faceted comparison of sodium chloride and corrosion-inhibited chemicals under real-world roadway conditions. Specific objectives include:

1. Compare snow and ice control costs of using sodium chloride to like costs using corrosion-inhibited chemicals.

2. Compare the results (i.e. road conditions) of snow and ice control activities carried out by using sodium chloride products to like results from the use of corrosion-inhibited chemicals.

3. Compare corrosion of metal exposed to sodium chloride to metal exposed to corrosion-inhibited chemicals.

4. Compare chloride levels in roadside soils, surface water, and underlying groundwater in areas using sodium chloride to chloride levels in areas using corrosion-inhibited chemicals.

TEST LOCATIONS: WSDOT initially selected two test locations where salt brine and rock salt would be the sole snow and ice control chemicals used. Two other sections were selected where corrosion-inhibited chemicals were the sole snow and ice chemicals used. Plowing and sanding activities were also conducted as needed in both salt and corrosion-inhibited chemical sections.

After the initial planning of the pilot project commenced, maintenance personnel from WSDOT's SW region expressed an interest in participating in the project. SR 6 between Chehalis and Raymond was selected as a section for salt use. A specific section of highway on which corrosion-inhibited chemicals were to be applied was not selected in the SW region for the purpose of comparing data with the salt section. Instead, two maintenance trucks that applied corrosion-inhibited chemicals on several highways in the general vicinity of SR 6 were selected for data comparison purposes.

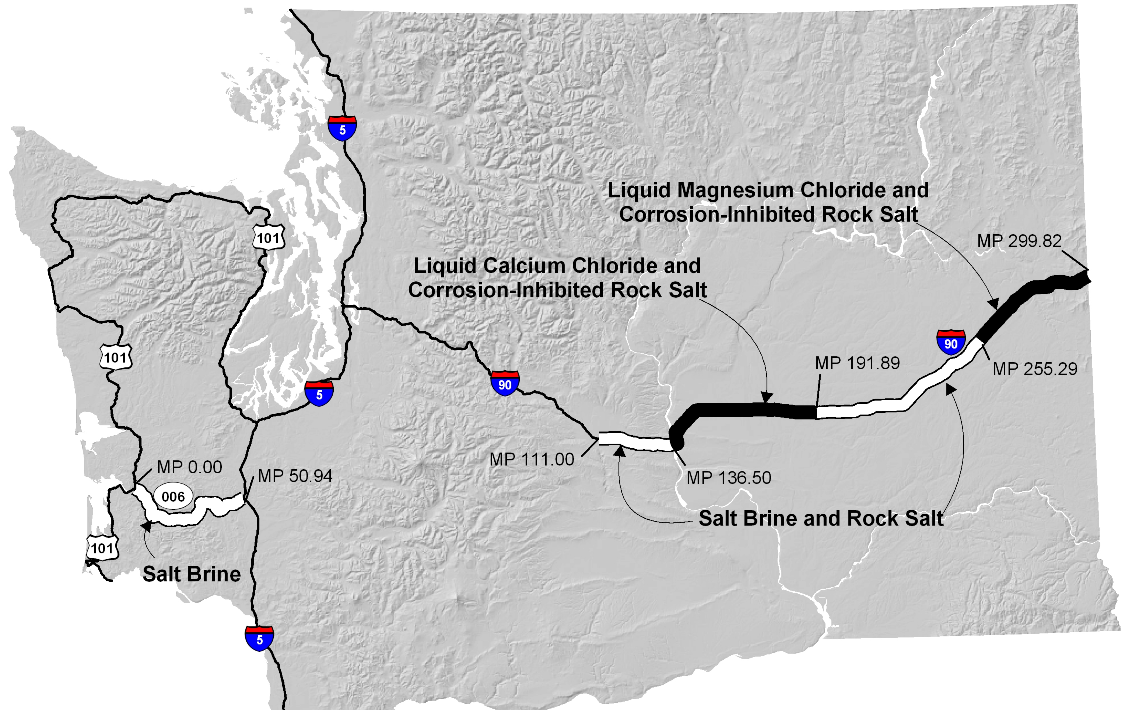


Figure 1: Salt and Corrosion-inhibited Chemical Test Sections

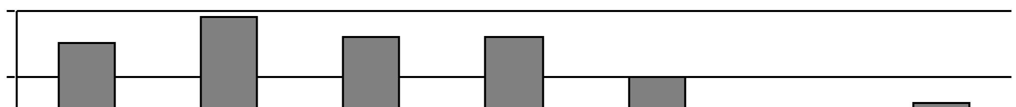
COSTS: Snow and ice control operational costs incurred during the pilot project were tabulated for each project section. The primary objective of documenting these costs is to be able to generate a general comparison of the operational costs of a maintenance program that is reliant on salt products for snow and ice control to a maintenance program that is reliant on corrosion-inhibited chemical products for snow and ice control. Cost items included in this tabulation are materials, labor, and equipment expenditures.
Several variables must be considered when assessing the costs of delivering a winter maintenance program. An example of this is in regards to costs per unit and application rates of anti-icing chemicals. Unit costs vary but so do required application rates. While the unit cost of a certain chemical may only be half of another chemical, the total costs may actually be more if the chemical has to be applied at a much higher rate. Another example is related to the roadway area of responsibility. Total monetary costs between two sections may be similar, but significant differences in miles of roadway maintained will provide important information about program efficiency. A simple way to improve the "fairness" of cost comparisons is to put total costs into terms of costs per lane mile over an entire winter season. While this doesn't factor in every possible variable, it does provide a generally good medium of comparison.

Location	Labor	Equipment	Materials	Lane Miles	$/Lane Mile
SC Region Salt	$10,467	$4,731	$54,479	102	**$683.10**
NC Region Corrosion-inhibited Chemicals	$24,347	$12,564	$117,501	222	**$695.55**
Eastern Region Salt	$30,090	$13,886	$66,385	253	**$436.21**
Eastern Region Corrosion-inhibited Chemicals Control	$41,492	$18,954	$286,670	210	**$1,652.93**
SW Region Salt	$4,042	$1,784	$5,914	103	**$113.98**

Figure 2: Salt Pilot Project Costs per Lane Mile

SNOW AND ICE CONTROL RESULTS/PERFORMANCE: WSDOT measures performance for a variety of maintenance activities using a program known as the Maintenance Accountability Process (MAP). Performance measures are focused on customer-oriented outcomes, or the results of maintenance work with which highway users can identify. Results are typically determined by field evaluations that assess the condition of highway system features. Results are identified in terms of Level of Service (LOS). LOS is communicated in terms of a letter-grade scale similar to school report cards. A LOS of "A" is the best LOS and a LOS of "F" is the poorest LOS.

Several roadway segments within the project sections were utilized for field evaluations and LOS calculation. A summary of the LOS ratings for each project section is shown below. The LOS rating for each section represents the average condition in which the subject roadway was maintained during the winter season.



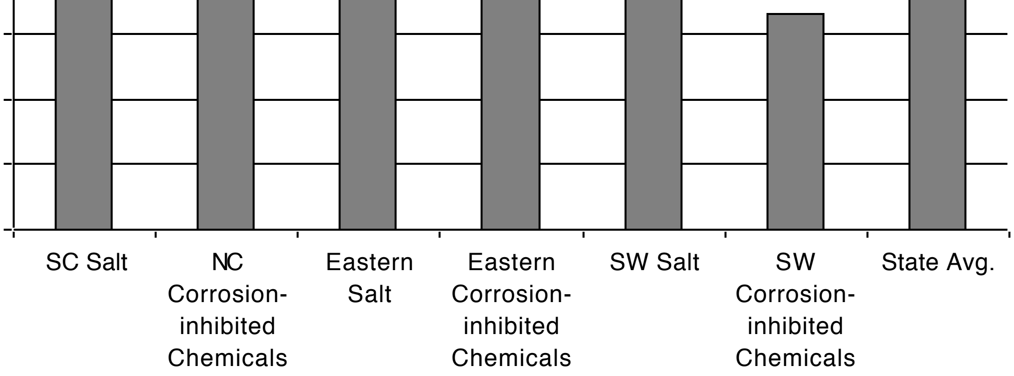


Figure 3: Level of Service Ratings for Project Test Sections

CORROSION STANDARDS: WSDOT is a member of a consortium of northwest state DOT's and Canadian provinces known as the Pacific Northwest Snowfighters (PNS). One of PNS's functions is to develop anti-icing chemical specifications that all member organizations utilize. The PNS specification for corrosion is that a corrosion-inhibited anti-icing chemical must be at least 70% less corrosive to a given type of metal than sodium chloride is corrosive to that same type of metal. This reduced level of corrosion is determined by a laboratory test.

Generally, the lab test consists of immersing and removing separate metal washers into a sodium chloride solution and a corrosion-inhibited chemical solution. Over a 72-hour period, the metal samples are immersed for fifty minutes and removed from the solution for ten minutes. This immersion/removal is done hourly for the 72-hour period. After the test period is complete, the metal samples are weighed. If the metal sample exposed to corrosion-inhibited chemicals has at least 70% less weight loss compared to the weight loss of the metal sample exposed to the sodium chloride solution, the corrosion-inhibited chemical meets the PNS specification.

MEASURING CORROSION IN THE ROADWAY ENVIRONMENT: The field replication of the laboratory corrosion analysis consisted of attaching samples of metal to WSDOT maintenance trucks working on highways where the only anti-icing chemical they would be exposed to is sodium chloride. Similar metal samples were attached to WSDOT maintenance trucks working on highways where the only anti-icing chemical they would be exposed to is a corrosion-inhibited product. Selected trucks were assigned to specific routes for winter maintenance to ensure that they would only be exposed to either type of anti-icing chemical. While the laboratory test uses metal washers, larger pieces of metal were used for the roadway corrosion test. With longer exposure times and more potential corrosion, it was felt that the smaller washers would be inappropriate for this use. The pieces of metal used are approximately four inches by six inches in dimension and are called coupons. Three types of metal were selected based on their common use in the automobile and truck manufacturing industry. Mild steel was selected due to its common use on a wide variety of motor vehicle components. A sheet aluminum alloy (type #5182) was selected due to its use in a variety of car and truck body panels. A cast aluminum alloy (type # A356) was selected due to its use in housings (i.e. transmission housings) of certain car and truck parts.

Each coupon was cleaned, prepared, and weighed. Two coupons of each of the three types of metal were attached to a rack that was in turn attached to WSDOT maintenance trucks. The racks were made of galvanized and painted steel. Coupons were attached to the rack with stainless steel nuts and bolts. Each rack (with mounted coupons) was then mounted
A uck that was used to conduct snow and ice control activities on the project sections.
B oupon racks were fitted between the truck chassis rails above the truck's differential.
LOS

LOS RATING

C

D

F

oupons and rack were marked for tracking purposes. Racks and coupons were fitted naintenance trucks for this evaluation. These were either dump trucks that applied :hemicals and/or sand or spray trucks or tank trucks that applied liquid chemicals.

ons and racks were also fitted onto four supervisor pickup trucks for a similar tion. Supervisor trucks are driven on a variety of highways in the course of daily In the evaluation, supervisor trucks in the test areas would be driven on highways where they would be exposed to both sodium chloride as well as corrosion-inhibited chemicals. Supervisor trucks in the corrosion-inhibited chemical sections would be driven on highways where they would be exposed only to corrosion-inhibited chemicals since no salt was used anywhere in these maintenance areas.

One set (steel, sheet aluminum, cast aluminum) of coupons was also fitted onto guardrail posts at select locations in each of the project sections. While they do not have the extensive exposure to anti-icing chemicals that WSDOT maintenance trucks have, they have some exposure from stormwater "splash" by vehicles driving on the highways. The guardrail along the project sections of I-90 is typically ten feet from the nearest travel lane. SR 6 does not have a similar, wide paved shoulder. At the location where the coupons were attached to the guardrail, they were seven feet from the nearest travel lane.

CORROSION RESULTS: Due to the number of coupons used in the corrosion evaluation, average weight loss amounts were calculated using all coupons of each metal type from each project section. The charts separate corrosion based on the type of metal coupon evaluated. The respective magnitudes of corrosion are significantly different. Weight loss in the steel coupons was on the order of grams. Weight loss in the sheet aluminum and cast aluminum coupons was much less; on the order of tenths of grams. The charts and narrative for the eastern and western Washington components of the pilot project are reported separately due to the differences in winter weather and snow and ice control methodology. More detailed corrosion information is contained in Appendix 3.

Interpreting Corrosion Results: To be included on a WSDOT contract, an anti-icing chemical vendor must submit samples of their anti-icing chemical and it must pass the corrosion-inhibition test (at least 70% less corrosive than sodium chloride, corrosion being measured in weight loss) as well as tests for other impurities such as heavy metals.
The charts used to depict corrosion rates compare amounts of corrosion in metal samples exposed to corrosion-inhibited chemicals to amounts of corrosion in metal samples exposed to sodium chloride. The target level of reduced corrosion (70% less than salt) is also shown on each measure for corrosion-inhibited chemicals. This way, the reader learns of the "target" and "actual" rates of corrosion.

CORROSION COMPARISON – SC REGION SALT AND NC REGION CORROSION-INHIBITED CHEMICALS: The following chart shows corrosion in steel coupons mounted on maintenance trucks, supervisor trucks, and guardrail in the SC salt and the NC corrosion-inhibited chemical sections. The maintenance truck-mounted coupons exposed to corrosion-inhibited chemicals had 53% less corrosion than similar coupons exposed to salt. The supervisor truck-mounted coupons exposed to corrosion-inhibited chemicals had 60% less corrosion than similar coupons exposed to salt. The guardrail-mounted coupons exposed to corrosion-inhibited chemicals had 17% *more* corrosion than similar coupons exposed to salt.

Comparison of corrosion weight loss in steel coupons between SC salt section and NC corrosion-inhibited chemical section

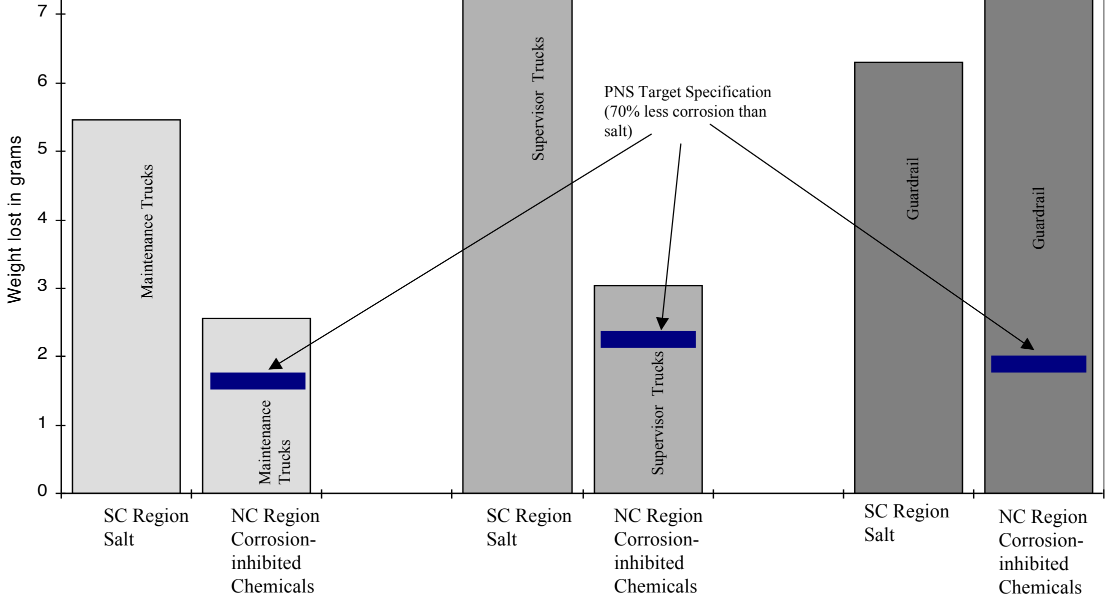


Figure 4: Steel coupon corrosion in SC and NC Region test sections

The following chart shows corrosion in sheet aluminum coupons mounted on maintenance trucks, supervisor trucks, and guardrail in the SC salt and the NC corrosion-inhibited chemical sections. The maintenance truck-mounted coupons exposed to corrosion-inhibited chemicals had 180% *more* corrosion than similar coupons exposed to salt. The supervisor truck-mounted coupons exposed to corrosion-inhibited chemicals had 13% *more* corrosion than similar coupons exposed to salt. The guardrail-mounted coupons exposed to corrosion-inhibited chemicals had 100% *more* corrosion than similar coupons exposed to salt.

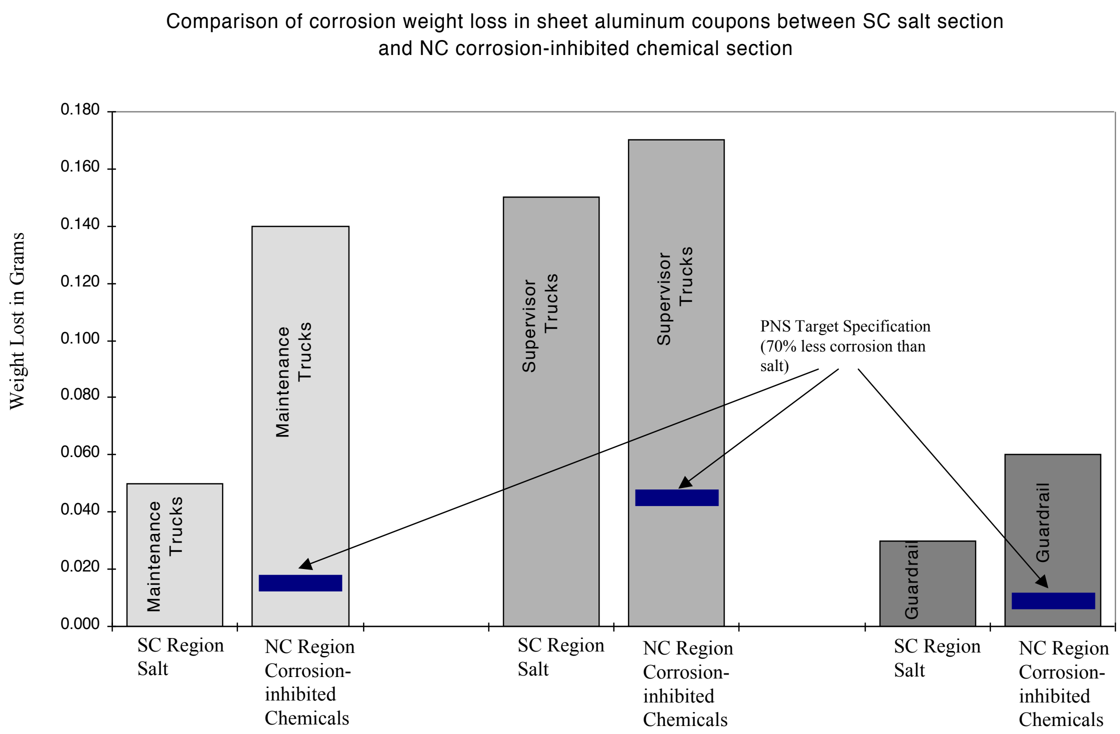


Figure 5: Sheet Aluminum coupon corrosion in SC and NC Region test sections

The following chart shows corrosion in cast aluminum coupons mounted on maintenance trucks, supervisor trucks, and guardrail in the SC salt and the NC corrosion-inhibited chemical sections. The maintenance truck-mounted coupons exposed to corrosion-inhibited chemicals had 25% less corrosion than similar coupons exposed to salt. The supervisor truck-mounted coupons exposed to corrosion-inhibited chemicals had 32% less corrosion than similar coupons exposed to salt. The guardrail-mounted coupons exposed to corrosion-inhibited chemicals had 143% *more* corrosion than similar coupons exposed to salt.

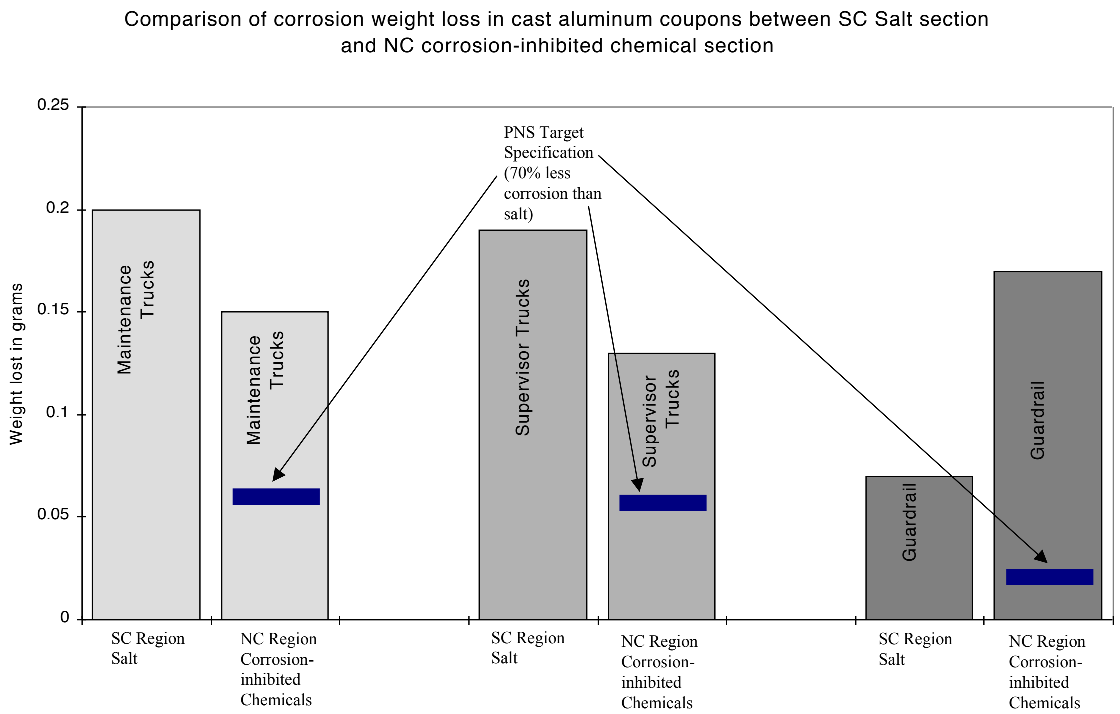


Figure 6: Cast Aluminum coupon corrosion in SC and NC Region test sections

CORROSION COMPARISON – EASTERN REGION SALT AND CORROSION-INHIBITED CHEMICALS: The nex chart shows corrosion in steel coupons mounted

INHIBITED CHEMICALS: The next chart shows corrosion in steel coupons mounted on maintenance trucks, supervisor trucks, and guardrail in the Eastern Region salt and corrosion-inhibited chemical sections. The maintenance truck-mounted coupons exposed to corrosion-inhibited chemicals had 30% less corrosion than similar coupons exposed to salt. The supervisor truck-mounted coupons exposed to corrosion-inhibited chemicals had 27% less corrosion than similar coupons exposed to salt. The guardrail-mounted coupons exposed to corrosion-inhibited chemicals had 9% *more* corrosion than similar coupons exposed to salt.

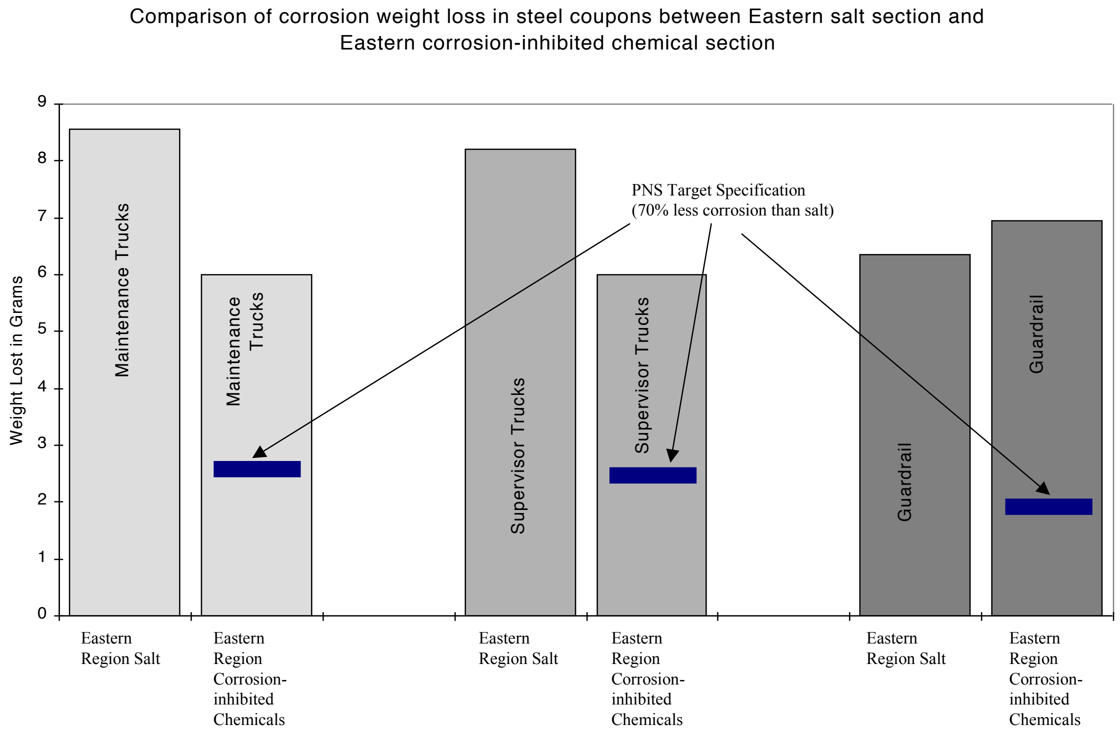


Figure 7: Steel coupon corrosion in Eastern Region test sections

The following chart shows corrosion in sheet aluminum coupons mounted on maintenance trucks, supervisor trucks, and guardrail in the Eastern Region salt and corrosion-inhibited chemical sections. The maintenance truck-mounted coupons exposed to corrosion-inhibited chemicals had 140% *more* corrosion than similar coupons exposed to salt. The supervisor truck-mounted coupons exposed to corrosion-inhibited chemicals had 162% *more* corrosion than similar coupons exposed to salt. The guardrail-mounted coupons exposed to corrosion-inhibited chemicals had 50% less corrosion than similar coupons exposed to salt.

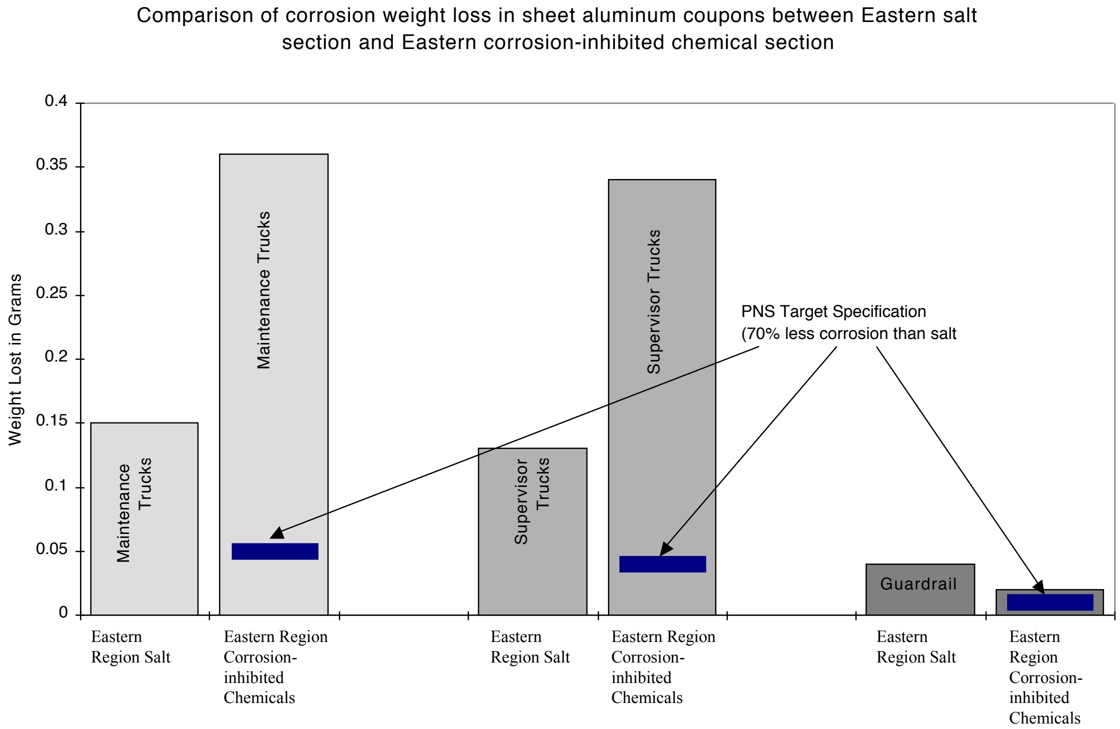
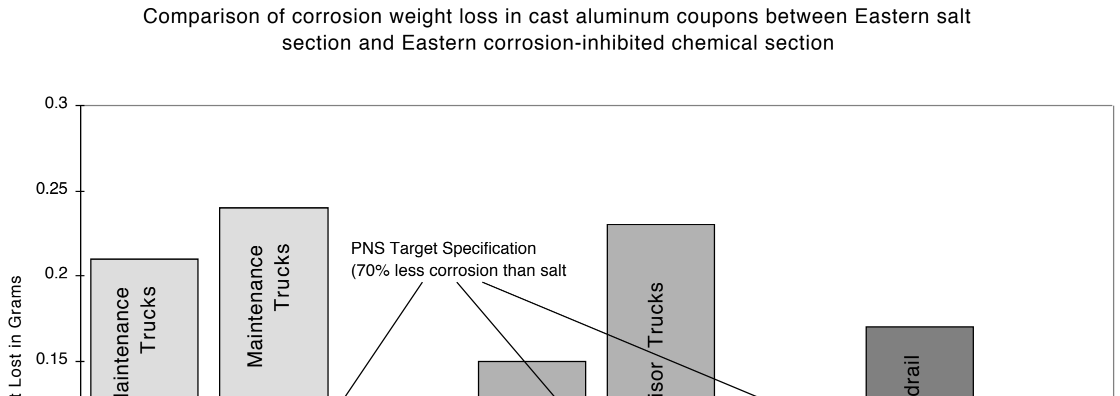


Figure 8: Sheet aluminum coupon corrosion in Eastern Region test sections

The following chart shows corrosion in cast aluminum coupons mounted on maintenance trucks, supervisor trucks, and guardrail in the Eastern Region salt and corrosion-inhibited chemical sections. The maintenance truck-mounted coupons exposed to corrosion-inhibited chemicals had 14% *more* corrosion than similar coupons exposed to salt. The supervisor truck-mounted coupons exposed to corrosion-inhibited chemicals had 53% *more* corrosion than similar coupons exposed to salt. The guardrail-mounted coupons exposed to corrosion-inhibited chemicals had 47% less corrosion than similar coupons exposed to salt.



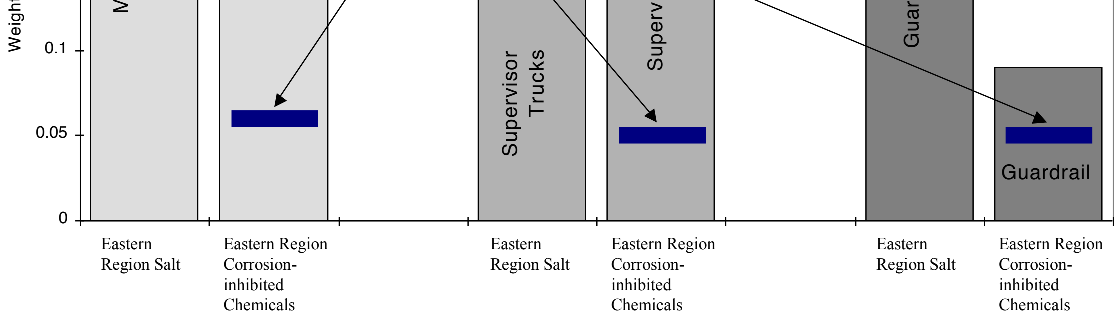


Figure 9: Cast aluminum coupon corrosion in Eastern Region test sections

<u>Discussion:</u> The steel coupons that were attached to maintenance trucks indicate that corrosion-inhibited chemicals provided some reductions (53% and 30%) to corrosion rates compared to corrosion rates of sodium chloride. These reductions fell short of comparable results from laboratory corrosion analysis as well as the PNS corrosion specification. Of the two corrosion-inhibited liquid chemicals used in the corrosion-inhibited chemical sections, the section using the liquid, calcium chloride product showed better corrosion reduction than the section using the liquid magnesium chloride product in both lab analysis as well as corrosion in the truck-mounted, steel coupons.

In most cases with both types of aluminum coupons that were attached to maintenance trucks, the corrosion rates from exposure to corrosion-inhibited chemicals were actually higher than in exposure to sodium chloride. Once again, the actual corrosion rates were significantly different from the PNS corrosion specification. The PNS corrosion specification and accompanying laboratory test were developed with corrosion to steel in mind. The information on the sheet and cast aluminum coupons indicates that the PNS specification has little to no relevance to actual corrosion of aluminum.

Both the steel and aluminum coupons mounted on the supervisor pickup trucks showed similar corrosion rates, as did those coupons from the maintenance trucks. For steel coupons, corrosion in the corrosion-inhibited control sections was less than that in the salt sections but far short of the PNS specification level. For the aluminum coupons, corrosion in the corrosion-inhibited chemical sections was either in excess or slightly less than in the salt sections and fell far short of the PNS specification level.

While the corrosion-inhibited chemicals resulted in some levels of reduced corrosion to steel coupons on maintenance and supervisor trucks, this was not the case with steel coupons mounted on guardrail posts. There was more corrosion on guardrail-mounted steel coupons exposed to corrosion-inhibited chemicals than those exposed to salt. Additionally, the total amount of corrosion on these coupons was greater than the total amount of corrosion on the truck-mounted coupons. While the reasons for this are unknown, it does raise the question of whether or not corrosion inhibitors are providing any actual corrosion reduction in bridges. If corrosion rates associated with corrosion-inhibited chemicals increase as they migrate ten feet from where they are applied to the roadway, will they also increase as the chemicals migrate into bridge decks through pavement cracks or drip down onto structural components of the bridge below the bridge deck? This corrosion information indicates that the PNS specification and accompanying laboratory procedure lack a direct and predictable relationship to corrosion rates that actually occur in the roadway and roadside environment.

Corrosion results in the SW region test area were generally similar to those reported above. As such, they are not reported separately in this paper.

ENVIRONMENTAL IMPACTS: As part of this pilot project, WSDOT environmental staff conducted field sampling and laboratory analysis to assess the level of chloride residue in the roadside environment.

<u>Sampling Methodology:</u> Within each of the four designated sections along I-90 (two sections using corrosion inhibited chemicals and two sections using sodium chloride), four sample locations were identified. These locations were generally chosen based on the potential for chlorides from highway snow and ice control activities to enter nearby waters. However, due to the semi-arid nature of the Columbia River basin, some sections did not have any water bodies nearby that were suitable for sampling. Two sample locations along SR 6 were selected at which standing water was present. All sample locations were recorded into a global positioning system. A total of forty soil, eight surface water, ten sediment, and four drinking water samples were taken during the pre-winter and post-winter sampling efforts.
Surface soil samples were collected from each location adjacent to the edge of the pavement, ten feet from the edge of the pavement, and in the sediment at the bottom of a roadside ditch or pond if present (see figure 19). Samples were taken at an approximate depth of three inches below the surface. Surface water bodies were sampled only if they were considered non-flowing, e.g. ponds, lakes. Flowing water bodies were not selected because of the dilution factor. Several past studies have shown that in flowing water, chlorides are rapidly diluted leaving little to no detectable chlorides. A ground water sample was also obtained from each I-90 section from water fountains located at Safety Rest Areas. Each of the Rest Areas is served by a WSDOT-owned well which serves the Rest Area only.

The pre-winter sampling event (sample1) occurred during the summer and fall of 2002. The post-winter sampling event (sample 2) occurred during spring of 2003. The pre-winter and post-winter samples were collected within one foot of each other.

<u>Results/Discussion:</u> Chloride levels in all mediums tested were fairly low (below 250 parts per million). There are several variables, which make comparisons of chloride levels in environmental compartments difficult. Sodium chloride and the corrosion-inhibited chemicals both contain chloride ions. Another variable is that both calcium chloride and magnesium chloride have twice the number of chloride ions as sodium chloride. The information does not reveal significant differences in chloride levels resultant of the application of corrosion-inhibited chemicals compared to sodium chloride. The information indicates that WSDOT's application of de-icing chemicals, either corrosion inhibited or sodium chloride is not resulting in chloride levels that are above any state or federal standard or guideline.

The information indicates that chloride concentrations in the soil are highest at the roadside and in the sediment and somewhat lower at the 10 foot sampling stations. This may be due to the fact that in most places along this stretch of I-90, the 10-foot station tends to be on a fairly steep slope. The drinking water data indicates no chloride influence from the anti-icing operation. No significant differences in chloride levels were identified at the end of winter compared to before winter commenced. Since no mid-winter snowmelt events were measured, it is unknown if short-term changes in chloride levels occurred during winter

SIGNIFICANT PROJECT FINDINGS: 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. In some scenarios, use of the corrosion-inhibited chemicals resulted in less corrosion than did the use of salt. However, the use of corrosion-inhibited chemicals did not meet the specification target in any of the scenarios evaluated. In other scenarios, the corrosion-inhibited chemicals resulted in more corrosion than did the use of salt. The significant differences in relative corrosion rates and the consistent pattern of not meeting the reduced corrosion specification strongly indicate that the current corrosion specification and related laboratory testing protocol lack a direct and predictable relationship to corrosion rates that actually occur in the roadway and roadside environment.

The corrosion-inhibited chemicals used in this evaluation generally appear to be more aggressive in corroding the sheet and cast aluminum alloys tested than does salt. It is not known whether this is caused by the chloride compound itself or the corrosion-inhibiting additive. The project findings seem to support the increasing complaints from motorists (including a significant amount of complaints from the trucking industry) about corrosion to aluminum. The focus of the development of the PNS corrosion specification was on corrosion to steel. The project findings indicate the specification does not address impacts to sheet and cast aluminum.

The project findings show some interesting variations in corrosion rates from the use of corrosion-inhibited chemicals. The chemicals meet, or come close to meeting, the corrosion specification when they are delivered to WSDOT maintenance yards. The chemicals' effectiveness (related to reduced corrosion) appears to be reduced after they are applied to the roadway and motor vehicles are exposed to them. As the chemicals are splashed off the roadway or otherwise migrate to the roadside, the findings indicate some significant changes in corrosion rates. In some cases, corrosion rates on the guardrail-mounted coupons were less than on the truck-mounted coupons. In other cases, corrosion rates were more than twice as high at the guardrail location than they were on trucks. This could have significant ramifications to corrosion issues related to bridges, steel re-bar in concrete pavement, and other metal-containing highway features. This is an area on which additional research should focus.

The general performance of salt was found to be favorable in comparison to the corrosion-inhibited chemicals tested. The maintenance crews using salt were able to deliver a Level of Service comparable to that delivered by crews using corrosion-inhibited chemicals. The primary limitation of salt is the relatively limited temperature range in which it will work. The mild winter during the pilot project was well suited for the use of salt. The lack of significant snowfall and black ice events during the pilot project resulted in limited opportunities for a full operational evaluation of salt.

The materials costs of using salt brine and rock salt were significantly less than comparable costs of using corrosion-inhibited chemicals. Use of a factory-built brine maker turned out to be a very cost-effective method of supplying maintenance crews with liquid anti-icers. There are indications that the cost of using salt could be less than that incurred during this evaluation. Looking at costs other than for materials, labor and equipment costs were comparable between those sections using salt and those sections using corrosion-inhibited chemicals. In evaluating environmental costs (impacts), there appears to be little to no difference in impacts between salt use and the use of corrosion-inhibited chemicals. They both are applied in a similar fashion and they both contain comparable levels of chlorides. In evaluating corrosion costs, the evaluation does not provide enough information for a definitive comparison. While the use of corrosion-inhibited chemicals appears to reduce corrosion (and hence some level of potential, eventual cost savings) of steel in motor vehicles, the findings indicate the possibility of less corrosion reduction (and hence some level of potential, eventual cost increases) as chemicals move from the roadway to the roadside. Also, while the use of corrosion-inhibited chemicals appears to reduce corrosion costs related to steel, it appears to increase corrosion related to aluminum. Some costs would also be associated with these impacts.

18
Washington State Department of Transportation
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Enrico V. Baroga —August 19, 2003