MAXIM
TECHNOLOGIES INC

Maxim Technologies, Inc
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REPORT OF : WATER ANALYSIS

PROJECT: MIDWEST RAILCAR REPAIR
BRANDON, SOUTH DAKOTA

REPORTED TO: MIDWEST RAILCAR REPAIR
ATTN: DAVID SMOOK
25965 482ND AVENUE
BRANDON, SD 57005

LABORATORY NO: 20-06175

Date Received: 7-06-00
Date Sampled: 6-30-00
Authorization: 7-06-00

Parameter *	Prior to cleaning 20-3630	Postwash prior to blasting 20-3631	Post wash Post blast 20-3632	MDL	Method	Analyzed
Total Phosphorus	9.5	0.27	0.33	0.01	365.3	7-11
Total Kjeldahl Nitrogen	8.2	<0.5	<0.5	0.5	405.1	7-11
Nitrate	0.23	<0.05	<0.05	0.05	354.1	7-7

MDL – Method Detection Limit
*All results are in milligrams
** EPA 600/4-79-020, "Methods for the Chemical Analysis of Water & Waste".

LABORATORY QUALITY CONTROL

		ACCURACY DATA		PRECISION DATA	
Parameter	**Sample**	**Matrix Spike Percent Recovery**	**Matrix Spike Duplicate Percent Recovery**	**Standard Percent Recovery**	**Relative Percent Difference**
T. Phosphates	20-3570	91%	101%	---	7.9%
TKN	20-3796	123%	118%	---	2.9%
Nitrate	20-3507	103%	99%	---	0.2 %

The samples were consumed in the analysis. If you have any questions or comments concerning this report, please feel free to contact us.

MAXIM TECHNOLOGIES, INC.
Jenelle Ollerich
Organic Chemist
Manager

Dan T. Hanson
Chemistry

"Providing Cost-Effective Solutions to Clients Nationwide"

HOUSTON
KTA
PITTSBURGH

KTA-TATOR, INC.

2105 Wilson Road, Humble, TX 77396
1-800 826-5381 * FAX (713) 540-1724

PROTECTIVE COATINGS (PAINT) CONSULTANTS: Testing - Instruments - Inspection - Analytical Laboratory

November 22, 1995

Jim Johnson
Chlor*Rid International Inc.
P.O. Box 908
2131 N. Longmore Street
Chandler, A7, 85224

SUBJECT: Investigation of the Effect of Chlor*Rid on Removing Chloride and Sulfate Contamination

Dear Mr. Johnson:

In accordance with your authorization of October 30, 1995 and our quotations of October 11 and 19, 1995, KTA-Tator, Inc. has completed a study to evaluate the effect of Chlor*Rid for removing chloride and sulfate from rusted steel panels.

SUMMARY

Abrasive blasted 4" X 6" steel panels were corroded by modified salt fog exposure (5% sodium chloride, NaCl, 2% sodium sulfate, Na_2SO_4) for 144 hours. Panels were removed, dried, and abrasive blasted to 2 mil profile with a mixture of aluminum oxide and coal slag abrasive. Following abrasive blasting, the panels were divided into three groups as follows:

- For extraction with water (as a control):
- For water blasting at 3000 psi, followed by extraction with water:
- For water blasting at 3000 psi with 1% Chlor*Rid, followed by extraction with water.

Analytical results for chloride and sulfate concentration are summarized below.

Group	Chloride Concentration micrograms/sq.cm	Sulfate Concentration micrograms/sq.cm	Comments
Control	9.6	0.5±0.3	No waster blasting
Water Blast	6.4	0.2±0.1	City Water
Chlor*Rid	2.8	0.2±0.1	1% in City Water

CHLOR*RID DEMONSTRATION AT JET PROPULSION LABORATORY

JANUARY. 22, 1997

On January 22 (1997) Jim Johnson, representing Chlor-rid, Inc., came' to the Jet Propulsion Laboratory to demonstrate the use of the Chlor-rid product which is also called Chlor-rid. Chlor-rid is a chemical concentrate of undisclosed composition which is claimed by the company to improve chloride removal when it is used in dilution as a rinse. Mr. Johnson brought his own prepared coupons, spraying solutions, and sprayer equipment. The sprayer equipment was mounted in the bed of his pick-up truck and consisted of a gasoline engine, a high pressure pump, tanks for both ordinary tap water and one-percent Chlor-rid solution, and the hoses and spraying wand.

The pre-treatment of the coupons, according to Mr. Johnson, consisted of eight days of exposure in a 'standard' salt spray cabinet at a moderately elevated temperature. The coupons consisted of rectangles of sheet steel, three inches by six inches in size and about 0.050 inch in thickness. They had all been grit-blasted before being rusted in the cabinet. The rusted coupons were removed from the cabinet and dried without rinsing. On the day before the demonstration, the coupons were grit-blasted again to remove the rust which had formed in the cabinet. This treatment was presumed to simulate the history of an actual surface being prepared for painting. Such surfaces have often been grit-blasted sometimes in their history, followed by painting and subsequent rusting in the normal environment, followed by another grit-blasting prior to repainting. According to Mr. Johnson, such grit-blasted surfaces, although they look clean, still retain a small residue of chloride that was present before blasting. Presumably the chloride becomes trapped as a result of the grit-blasting process, maybe because of the impact working of the surface by individual grits. Mr. Johnson explained that the Chlor-rid was especially designed to remove the chloride that is trapped by the grit-blasting. It may be unnecessary or superfluous for surfaces which have not been grit-blasted.

When I got a chance to inspect the prepared coupons at JPL, they showed a course grit-blasted texture which was slightly streaked with light rust. Most of the area was of a clean gray appearance. Both sides of the coupons had received the same treatment and were indistinguishable from each other. Mr. Johnson attributed the light rust streaks to the moisture they had been exposed to on the one day which had elapsed since the blasting. The weather had been rainy and drizzly for several days and the explanation seemed reasonable.

Six coupons were set aside as controls and were not sprayed. Six coupons were sprayed with a one-percent (by volume) solution of Chlor-rid and six were sprayed with ordinary tap water. For spraying, the coupons were hung, six at a time, on a special hanger which consisted of a metal strap about three feet long with projecting screws to serve as hooks. The coupons each had a hole at one end to fit over the screw/hooks. The spray emerged from the nozzle at a pressure of about 1000 psi, diverging to an cross-sectional area about a half-inch in diameter at the working distance of two or three inches. The spray was moved back and forth over the area of each coupon, attempting to cover the whole area with the high pressure part of jet. The coupons were reversed on their hooks to spray the back in a similar way.

Samples of the Chlor-rid spraying mixture and the tap water were taken directly from the supply tanks for later analysis.

After spraying, the coupons were removed from the hanger u sing clean rubber gloves and placed in a Pyrex dish. Each coupon was then dried by holding it with tongs in the heated stream of air from a hot air gun. The dry coupons were set aside for subsequent measurement of their residual chloride.

The measurement of the residual chloride was done by boiling the coupons individually in deionized water. Approximately one liter of deionized water was used and the boiling was done on hot plates using stainless steel beakers -with aluminum foil covers. During the boiling, which was continued for about 1 hour and a half, the volume of water was reduced at different rates in the, different beakers. Additional water was added where necessary to keep the coupons immersed. At the end of the boiling period, the coupon was removed and the volume of water remaining was measured. A small portion of the water was put in a glass sample bottle for chloride determination and the rest was discarded. All eighteen coupons received the same treatment.

The chloride content of the boil-water samples and of the wash solution was measured using a Dionix ion chromatograph. The samples were measured without the addition of buffer. Standard solutions containing 2 ppm chloride were run before and after the other samples. The data and the chloride determinations are contained in the table below.

Lessons for Salt Measurement from the Chlor-rid Testing

The Chlor-rid testing has brought home to us an unpleasant fact, that some surfaces retain salt more effectively than others. During our salt measurement experiments, we have concentrated on relatively smooth surfaces. Nor have we done any measurements on surfaces where chloride may have been 'worked' into the surface by grit blasting. The texture of rough surfaces may retain salt by itself, which requires high pressure jet blasting to extract. It may be that this salt will not be removed by low pressure methods such as simple swabbing or the Bresle patch.

Salt can be retained under and interspersed in a porous rust layer. Simple swabbing or soaking (as with the Bresle patch) will not remove all the salt that is trapped in the rust. To remove this salt from the surface, the rust should probably be dissolved with acid. Where the surface has previously been grit blasted, a longer exposure to acid may be necessary.

Fortunately, there seems no easy way to use high pressure while sampling. May be useful to use ultrasound to agitate the water in a sample patch.

Pressures may be achieved in this way that are equivalent to a water jet.

	(micrograms per square centimeter)			
	Flouride	**Sulphate**	**Chloride**	**As Sodium Chloride**
Unsprayed 1	0.36	0.62	4.60	
Unsprayed 2	0.49	0.95	4.02	
Unsprayed 3	0.35	1.40	4.63	
Unsprayed 4	0.63	N/A	4.37	
Unsprayed 5	0.53	0.72	5.20	
Average	0.47	0.87	4.56	7.52
	(Chloride Standard Deviation)			
	Flouride	**Sulphate**	**Chloride**	**As Sodium Chloride**
Tap Sprayed 1	0.54	0.79	6.46	
Tap Sprayed 2	0.21	0.85	5.36	
Tap Sprayed 3	0.92	0.92	4.33	
Tap Sprayed 4	0.77	N/A	3.39	
Tap Sprayed 5	0.76	0.92	4.05	
Tap Sprayed 6	0.24	0.59	2.67	
Average	0.57	0.81	4.38	7.23
Chlor-rid 1	0.66	0.97	3.01	
Chlor-rid 2	0.71	0.81	3.01	
Chlor-rid 3	0.27	0.80	2.54	
Chlor-rid 4	0.40	0.83	3.37	
Chlor-rid 5	0.29	0.68	2.16	
Chlor-rid 6	0.57	0.87	2.84	
Chlor-rid				
Chlor-rid				
Average	0.48	0.83	2.82	4.65
Chloride Standard Deviation			0.42	

To: Jerry Ludwig
From: Tim Miller
8/o/96
11-TM-13

Chloride Ion Tests With Sea Water

A: Purpose-

To find out if places that had limited fresh water, , like off-shore oil rigs, could use salt water with our Chlor*rid product and get a low chloride residual ion concentration.

B: Experiment-

1. Place Q-Panel in 5% Muriatic solution for 10 min.
2. Remove panel and let dry -
3. Rinse panel with selected solution by placing solution in a squeeze bottle and squirting solution over panel about 3 times on each side

   A. Rinse solution I was 100% sea water

   B. Rinse solution 2 was 100:1 mixture of sea water to Chlor*rid

   C. Rinse solution 3 was 50:1 mixture of sea water to Chlor*rid

   D. Rinse solution 4 was 10:1 mixture of sea water to Chlor*rid
4. Let panel dry completely after rinse before proceeding
5. With equipment provided in S.C.A.T. Kit and a bag of cotton balls do as follows-

   A. Remove 2 cotton balls with tweezers
   B. in provided 100ml beaker put 25ml of distilled water
   C. Using tweezers wet one cotton ball and squeeze out
   D. Sub cotton ball over rinsed panel using tweezers
   E. Rinse cotton ball in water
   F. Repeat steps C, D, & E with same cotton ball
   G. With 2nd cotton ball remove excess liquid from panel and rinse cotton ball in beaker
   H. Place Q-Tab titrator in beaker and wait for results
   I. Compare results to Q-Tab chart

C: Results of Chlor*rid & Sea Water Tests

No rinse- Cl Ion Concentration- 45ppm
Rinse with distilled water- Cl Ion Concentration- 10ppm
Rinse with 100% Sea Water- Cl Ion Concentration- 25ppm
Rinse with 100:1 concentration- Cl Ion Concentration- 10ppm
'Rinse with 50:1 concentration- Cl Ion Concentration- 5ppm
Rinse with 10:1 concentration- Cl Ion Concentration- 5ppm

D: Conclusion-

With a 100:1 concentration you can considerably lower the Chloride ion concentration and with higher concentrations of CHLOR*RID you can lower the concentrations even more, but there probably isn't a chance of getting a 0 ppm reading.

CHLOR*RID removes chlorides and sulfates from contaminated surfaces in a single dilution with any potable water source. **CHLOR*RID** is biodegradable, non-flammable and contains no volatile organic compounds. Laboratory and field tests confirm that **CHLOR*RID** is effective for removing chlorides and sulfates from industrial surfaces

> **CHLOR*RID** is a unique organic bonding chemistry which aids in the removal of chlorides, sulfates and most soluble salts.

Wasser High-Tech Coatings, Tnemec Company, and Advanced Polymer Sciences, and Plastite have tested**CHLOR*RID** with their coatings and found that it does not interfere with the adhesion of their coatings. Scanning Electron Microscopy (SEM) inspection by KTA Tator Laboratories established that **CHLOR*RID** leaves no film or residue after use.

Contamination free results are what truly counts.**CHLOR*RID** is the easiest and most economical way to remove soluble salt contaminants with any method - high pressure washing, wet abrasive blasting or even hand-cleaning.

(Adobe Acrobat Reader required to view the following files).

KTA Tator Laboratories Letter on the investigation of the effect of **CHLOR*RID**on removing chloride and sulfate contamination.

MAXIM Letter on the report of water analysis.

Jet Propulsion Laboratory Letter on **CHLOR*RID's**demonstration.

Chloride Ion Tests with Sea Water Letter

Adding **CHLOR*RID** to the regular maintenance pressure wash of aircraft will increase the effectiveness of chloride and sulfate removal.

If salts are soluble, why doesn't water remove them?

Because they are electrochemically driven to the substrait and are attached with greater strength than the forces applied to remove them.