



### Laboratory Developments

by Art Ahlbrecht, VP of R&D

A major function of the laboratory is to keep up with new developments world wide and to follow corrosion abstracts, which is our main source of information. We receive the publication every two weeks and review the forty or so pages of abstracts of every corrosion article and corrosion patent applications published.

Last week an abstract of a corrosion review article by a German professor caught our attention and we requested the article. Our interest was aroused by several paragraphs in the review that described the use of nano-technology in corrosion control. At Cortec® we have had a program underway with nano particles in the laboratory and know how to use the technology to bring the top performance of our products to an even higher level. Stay tuned!!!

### Bio-Products

The laboratory is working closely with Bob Boyle on new and modified products that can be developed with our Eco Film and Eco Works Films. The new technology we have developed in cooperation with Cargill-Dow is finding interest world wide. It took a while but Cargill-Dow finally recognized that Cortec® is open to ideas and produces results. Cargill-Dow in a 1996 publication listed films with poly-lactic acid as potential new products. The improvement we have made with our Eco Works films in 2003 (seven years later) is the main focus of the cooperative efforts. At times a little company can move faster than the giants! Stay tuned!



### GalvaCorr (License from NASA)

The World of Concrete meeting in Orlando, Florida, in February will introduce the new galvanic coating that has been under development. We are pleased to hear that several engineers from NASA will be assisting in our booth.

**GalvaCorr**

### New Products

by Margarita Kharshan, Lab. Director

As the new year is upon us, this is an appropriate time to reflect on the past twelve months.

Looking back, it has been a full and productive year for the Cortec® Laboratory. We have finished a lot of interesting developments, such as biodegradable films, galvanic coating for concrete, new high temperature coatings, biodegradable water-treatment additives, new surface preparation products, and more. Some of the new products have already moved to the field, while other products are under customer evaluation.

The feedback we are getting about these products is very encouraging as customers like the combination of excellent anticorrosion performance and environmentally sound properties. Many exciting applications for new products developed recently by the Cortec® Laboratories are happening daily: our MCI® product is extending the service life of the Pentagon; cities of Hutchinson, MN and Cardiff, Wales are using EcoWorks bags in their composting programs; NASA endorses our products for corrosion protection of the entire space program, etc. We are proud to see that our research and development and our technical support to our customers is paying off!

As always, the bottom line for our work on development of new technologies and applications is "what can we do for our customers?" We would like to take this chance to thank all our customers, distributors, representatives, all our friends and colleagues for their assistance and contributions throughout the long and often hectic year.

We look forward to the new year, and the challenges and opportunities it will bring.

In this newsletter we are introducing 9 new products that cover a wide range of applications and means of delivery.

## We Are Opening a New Page in the Water-treatment Applications!

### S-14 Bio and BioClean 610

#### Unique New Water Treatment Solutions

by Greg Hocking, Water Treatment Technical Service

It is certainly no secret that Cortec® strives to develop and manufacture products that exhibit new industry standards in corrosion protection. However, the Research and Development team at Cortec® also continues to investigate new ways to incorporate renewable, and biodegradable resources into all of our products. Products that not only exhibit environmental friendliness, but also maintain or exceed the performance requirements for which they are designed. The following are two exciting new examples of this marriage of performance and practicality for the Cortec® Water Treatment product line:

### S-14 Bio

#### Scale and corrosion control combined in a safe, readily biodegradable new product from Cortec® Corporation

S-14 Bio is a truly unique feed water treatment product designed for cooling towers and other open-loop, recirculating cooling systems. S-14 Bio is a rare combination of powerful scale inhibition and excellent multimetal corrosion protection. Amazingly, it also boasts a formulation that is comprised of non-toxic, non-hazardous, readily biodegradable ingredients. It's main component is a low molecular weight, natural polymer, and the other components are all GRAS (Generally Recognized as Safe) substances and food approved preservatives.



S-14 Bio was compared to other commonly used antiscalant products such as, phosphonates, polyacrylates, and relative newcomer, polyaspartic acid. Scale inhibitory ability was evaluated using the following tests:

NACE Standard TM0374-2001\*, ASTM D 1126\*\* (to evaluate Calcium Carbonate [CaCO<sub>3</sub>] and Calcium Sulfate [CaSO<sub>4</sub>] scale inhibition). In addition, half immersion tests were completed on carbon steel, aluminum, galvanized, and copper (to evaluate the corrosion protection offered in the liquid phase, the vapor phase, and at the water-air interface).

The low molecular weight, natural polymer performed very well in scale inhibition trials. It outperformed both phosphonate and polyaspartic acid in CaSO<sub>4</sub> scale protection, with comparable results to the polyacrylate product. Meanwhile, performing comparable or better than both polyacrylate and polyaspartic acid in protection from CaCO<sub>3</sub> scale formation.

\* NACE Standard TM0374-2001 "Laboratory Screening Test to determine the Ability of Scale Inhibitors to Prevent the Precipitation of Calcium Sulfate and Calcium Carbonate from Solution"

\*\* ASTM D 1126 "Test Method for Hardness in Water"

The unique formulation of S-14 Bio also provides superior corrosion protection than that of these other common antiscalant products. The phosphonate provided protection to carbon steel only, while the polyacrylate product attacked the copper sample. And, while polyaspartic acid proponents tout it as a corrosion inhibitor, it too was outperformed in the multimetal protection offered by S-14 Bio. Without true multimetal protection, supplementary corrosion inhibitor addition is generally required to the system. This can cause problems in compatibility as well as change the biodegradable and safety characteristics of the treatment formulation.

In summary, when you combine the scale and corrosion protection offered by S-14 Bio, with its readily biodegradable formula, you truly do have a unique water treatment solution. An effective, economically sound, easy and safe to handle product, in a field which surely desires this type of innovation.

### BioClean 610

#### Another Cortec® innovation, combining non-hazardous, renewable, and biodegradable properties with powerful bio-inhibitory performance.

BioClean 610 is another exciting new water treatment product recently born in the Cortec® Laboratories. BioClean 610 provides strong preservative and biological growth inhibitory characteristics, but also maintains the safe, non-toxic, and biodegradable status which has become a staple of Cortec® Research & Development. Like S-14 Bio, BioClean 610 is designed to change the way we approach water treatment applications.

Developed with a coconut oil-based phospholipid technology, this product delivers benefits to environment and person that conventional products in this field balk at. This technology is absolutely biodegradable, and renewable. It is also gentle, non-irritating, and is naturally neutral in pH. Examples of the same technology in BioClean 610 can also be found in cosmetics and personal care products (e.g. hand cleaners, shampoos, and even baby wipes).

However, BioClean 610 does not only boast friendliness as a benefit. This product also delivers broad spectrum antimicrobial activity. Its Microbiological Inhibitory Concentrations (MIC) were equivalent or better than every other product we compared it against, including a couple of Cortec's established raw materials. Raw materials that have served Cortec® in this application in the past, but that display extremely strong odors, high pH's, and irritating if not hazardous side-effects. BioClean 610 also outperformed in laboratory tests using highly contaminated cooling tower basin water. Biological growth agar assays\*\*\* were taken, and 610 easily dispersed the contaminants (under 24 hours) and preserved the system from further growth. At concentrations between 100-200ppm!

BioClean 610 is another development that will have true value in the field of water treatment. A product that combines all the properties which are desired of new age products, in a field that continues to become one of Cortec® Corporations specialties.

2 \*\*\* Assays were taken using Duo Bio Dipslides, cat. number BTM2, from Wet Environmental Technologies.

## S-15

### Important Addition to the Boiler Treatment Line

Our new Boiler Treatment Additive S-15 specifically designed for protection of medium and high pressure boilers and is a very good addition to the Cortec's water-treatment line.

For industrial and commercial boilers it is critical to minimize corrosion and deposits in the boiler systems in order to maximize energy efficiency and life span. The gases typically dissolved in water, such as oxygen and carbon dioxide, lead to corrosion. Oxygen causes pitting and rusting while carbon dioxide causes acid corrosion.

S-15 is very effective in controlling corrosion caused by oxygen and carbon dioxide to high and medium pressure boilers and their condensate lines.

S-15 utilizes the combination of volatile neutralizing amines in conjunction with an oxygen scavenger - metal passivator. This combination improves corrosion control in two ways. First, because any acidic species present is neutralized and the pH is increased, therefore condensate becomes less corrosive. Second, the oxygen scavenger/passivator reacts more rapidly at the mildly alkaline conditions maintained by the amines than at lower pH levels.

S-15 has several advantages:

- S-15 does not leave solid residue in the boiler systems and helps to provide high quality steam.
- S-15 provides excellent passivation, high volatility, thermal stability, and low toxicity
- S-15 doesn't contain any hazardous materials like hydrazine and its derivatives.
- This product is very economical - usually it requires 2-5 ppm of continuous treatment.



## MCI® Products in the News

### DOT Approval

Cortec's MCI®-2005 and MCI®-2005 NS got approval from Ohio State Department of Transportation for use in all construction work. This approval is a testament of the hard work to everyone from Cortec® involved in this event.

### UL Approval

We also proud to announce that six of Cortec's MCI® products have recently received UL approval. After completion of Engineering evaluation UL has found all of these products are in compliance with requirements for product classification in accordance with ANSI/NSF Standard 61 (potable water applications).



MCI®-2005, MCI®-2005 NS, MCI®-2006, MCI®-2006 NS, MCI®-2020, MCI®-2020 M

### Anti-graffiti Architectural Coating

Cortec® has recently developed an anti-graffiti coating for concrete. This two-component, solvent based urethane coating is designed for easy removal of ink or paint graffiti applied to concrete. Most solvents can be used to remove this graffiti. In addition, Cortec's VpCI®-432, VpCI®-433 and Eco Spray Graffiti Remover 433 can be utilized when solvent resistant graffiti is encountered. Anti-graffiti Architectural Coating has excellent adhesion properties when applied over MCI®-2020 M.

Cortec® Anti-graffiti Architectural Coating is extremely hard and has a low coefficient of friction. This coating can also be applied as a topcoat to solvent based coatings on steel.



## Cortec's Innovation in Packaging Line

### Cortec® Laboratories Introduce High Performance, Bio-based and Biodegradable Film - Eco Works!

Eco Works is one of the latest innovations in Cortec's expanding line of biodegradable films. Eco works is a unique blend of high performance and naturally derived biodegradable polyesters that allow the physical properties of the end product to be customized for a wide variety of applications. Some of the customizable features include clarity, transmission rates (oxygen and moisture), rigidity and strength. Additionally, the improved strength of Eco Works allows for a variety of convenient features available on traditional bags including the drawstring for easy handling.





Eco Works also complements Eco Film allowing sales people to replace even more non-degradable films for customers. Whereas Eco Film is elastic and silky, Eco Works is rigid and resembles high-density polyethylene. Those who attended the World Sales Meeting last year have already received a sample of Eco Works. The Cortec® trade show bags are now made from Eco Works film.

Eco Works is ideally suited for collection bags requiring longer curb-life, and applications requiring a more rigid film, like food packaging and agricultural uses. Eco Works has a couple sales advantages over Eco Film; Eco Works costs slightly less and is derived from corn material therefore allowing preferential government purchasing.

### EcoCorr® ESD Film

Cortec® is leading the biodegradable film industry with its newest release: EcoCorr ESD. This film is 100% compostable/biodegradable and provides both anti-static and corrosion inhibiting protection. EcoCorr ESD is completely stable in atmospheric conditions. It will not begin to break down until exposed to compost or soil conditions where it will convert to water and carbon dioxide in 6-7 weeks. EcoCorr offers contact, vapor and barrier corrosion protection giving customers a complete corrosion inhibiting packaging film.



EcoCorr ESD film satisfies strict compostability and biodegradability requirements of ASTM D 6400-99 and DIN V 54900 and meets MIL-PRF-8175D with respect to static decay. It also fulfills surface resistiv-

ity Section 4.6.8 of Performance Specification MIL-PRF-8175D. EcoCorr ESD has a static decay rate time of 0.02 seconds when exposed to 5000 volts, well below the limit of 2 seconds. Its surface resistivity is 109 Ohms/sq, easily within the required range (105 to 1012). It also meets MIL-B-22019 and MIL-B-22020 for anticorrosion films or bags.

EcoCorr ESD has no special disposal requirements; the film can simply be discarded after use. One of the major advantages to Cortec's VpCI® technology is that it doesn't require removal. Unlike traditional corrosion inhibiting and anti-static coatings, metal protected by EcoCorr ESD is immediately ready for use. EcoCorr ESD has a two year shelf life plus an additional two years of static and corrosion protection once in use.

### VpCI®-126 Bio

This product is a great addition to the Cortec's line of biodegradable products.

VpCI®-126 Bio is a unique combination of polyethylene film and a microbial activator that creates a superior performing anti-corrosive film that will biodegrade under many common

methods of disposal. The microbial activator in the VpCI®-126 Bio film causes communities of microorganisms to interact with the high molecular weight polyethylene until the carbon chain of polyethylene is small enough to be consumed by the same microorganisms. Since microbial activity is the cause of the biodegradation, VpCI®-126 Bio must be disposed of in direct contact with organic material to begin and complete the biodegradation process.



Technically, the VpCI®-126 Bio films AEROBICALLY and ANAEROBICALLY biodegrade which results in the release of carbon dioxide and water or methane and water respectively. The time needed for the film to biodegrade is entirely dependent on the environmental conditions that exist when the film is discarded and typically ranges from 9 to 60 months.

In addition, VpCI®-126 Bio film provides superior contact, vapor and barrier phase corrosion inhibition. The structure of VpCI®-126 Bio provides a lower MVTR (water permeation is limited) rating than conventional low-density polyethylene films.

### SilverBrite VpCI® Paper

SilverBrite VpCI® Paper is a new product from Cortec® Corporation specifically for the protection and packaging of



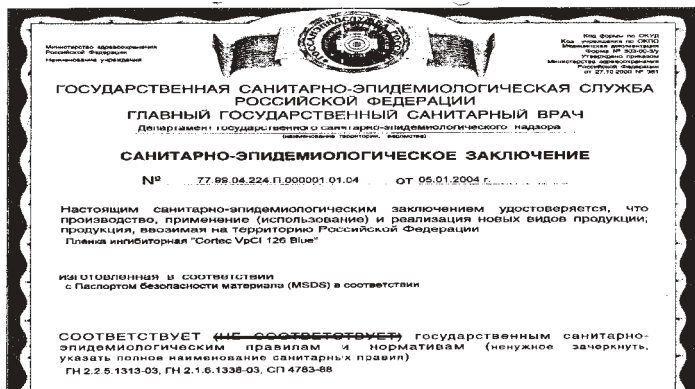
precious metals such as silver, gold, tin and copper. SilverBrite offers a cost effective and easy to use method of corrosion protection for valuable metals. This unique paper contains a hydrogen sulfide scavenger and saturation indicator on the outside of the paper that automatically turns to a darker color when a substantial amount of hydrogen sulfide has been absorbed. This indicator tells customers when the paper should be replaced. In addition, SilverBrite VpCI® paper is effective in aggressive environ-

ments, including humidity, sulfur dioxide, galvanic corrosion from dissimilar metals and harmful contaminants in air. The vapor phase corrosion and tarnish inhibitors in SilverBrite VpCI® paper vaporize and deposit an invisible, molecular layer of corrosion and tarnish inhibitor over the entire surface of the precious metal. SilverBrite VpCI® paper will eliminate the need for coatings and tarnish removers that often are associated with

precious metals. When removed from SilverBrite VpCI® paper, precious metals will look exactly as they did before they were protected with SilverBrite. Typical applications include electrical components, controls, silverware, jewelry box linings, shipping container linings and wrapping. SilverBrite VpCI® paper is non-toxic and contains no nitrites, phosphates, silicones, chromates or other heavy metals. SilverBrite VpCI® paper is already approved by a number of companies for use on electronic devices.

### Additional Approvals for VpCI®-126 Film

Cortec's VpCI®-126 Film is getting more and more approvals from the Health Departments of different countries and regions. The latest approval was received from Russian Government - Russian Health and Environment Protection Agency.



### EcoShield VpCI® Linerboard

In addition to its superior anti-corrosion qualities, EcoShield VpCI® Linerboard offers barrier protection. It is coated with an impervious layer that reduces the transmission of moisture through the linerboard. Additionally, EcoShield VpCI® Linerboard has moisture vapor transmission rates similar to those of polycoated and waxed papers. The barrier layer includes our patented VpCI® technology, which is the industry's forerunner in corrosion protection. Both ferrous and non-ferrous metals are protected from corrosion. EcoShield VpCI®



Linerboard offers the unique advantage of being fully recyclable (repulpable). This eliminates the need for expensive processes to separate the paper base from the coating. EcoShield VpCI® Linerboard protects metal parts for storage and shipments in either box, interleaving or insert formats.

### Common questions regarding Cortec's coating additives

#### Cortec's Coating Additives vs. Zinc Phosphate

by Michael Prenosil, Coating Specialist

Cortec® has done considerable work comparing zinc phosphate and modified zinc phosphate pigments against or with Cortec's additives. Cortec® has corrosion inhibitors designed specifically for waterborne applications and inhibitors for solvent based coatings.

There are two types of waterborne corrosion inhibitors: flash rust inhibitors and long term inhibitors. Cortec's flash rust inhibitors are M-435, M-240, and M-111. They are not designed to compete with zinc phosphate since they are used only to prevent rusting during the initial drying of the coating.

The best long term waterborne corrosion inhibitors are M-119LV, M-380, and M-381. M-119LV can be used in most water based coatings to improve the corrosion protection. If there is a relatively high level of carboxylate groups in the latex, M-380 or M-381 can be used to significantly improve the corrosion protection. M-380 contains ammonia and tends to kick out a number of latices. M-381 has no ammonia and is essentially a combination of M-119LV and M-380 with a flash rust inhibitor. Specific examples are given below:

#### Example 1

A customer wanted to improve corrosion resistance using an acrylic latex coating containing zinc phosphate. The addition of 2.5% M-381 improved the coating significantly.

Coating	Test/Hours	Film Thickness	Scribe (1) Corrosion	Non-Scribe (2) Corrosion
Zinc Phosphate	Salt Spray/20	32.5µ	9	4
+ 2.5% M-381	Salt Spray/20	32.5µ	10	9
Zinc Phosphate	Humidity/150	30µ	N/A	2
+ 2.5% M-381	Humidity/150	30µ	N/A	8

There was a significant improvement using 2.5% M-381. The coating would probably be equal or better using only 2.5% M-381 and no zinc phosphate; but the customer did not require this information.

#### Example 2

Another customer wanted Cortec® to compare a styrene acrylic latex modified zinc phosphate coating with one using a Cortec® additive.

Coating	Test/Hours	Film Thickness	Scribe Corrosion	Non-Scribe Corrosion
Mod. Zn Phosphate	Salt Spray/1000	65µ	6	6
1% M-119LV	Salt Spray/1000	60µ	8	8

Again with this much higher quality coating, a significant improvement in salt spray resistance was noted. The customer did not mention what % modified zinc phosphate was added.

**Example 3**

Cortec® ran a direct comparison using Akzo latex USPD 590-37 in a clear coating:

Coating	Test/Hours	Film Thickness	Scribe Corrosion	Non-Scribe Corrosion
2% Mod. Zn Phosphate	Salt Spray/345	30µ	7	3
3% M-381	Salt Spray/345	30µ	7	8

The non-scribe corrosion was significantly better using M-381 than the modified zinc phosphate.

**Example 4**

Cortec® also tested Reichhold's Arlon 847-2-42 using Cortec's M-119LV.

Coating	Test/Hours	Film Thickness	Scribe Corrosion	Non-Scribe Corrosion
2% Mod. Zn Phosphate	Salt Spray/144	37.5µ	9	7
3% M-119LV	Salt Spray/144	37.5µ	10	9

Cortec's M-119LV out performed the modified zinc phosphate again.

Solvent based coatings require different Cortec® additives. M-5365 and M-168 are the recommended corrosion inhibitors to use. M-5365 has shown to be superior in head to head studies against zinc phosphate. M-5365 is particularly good when used in VT alkyds and straight alkyds. Several examples are given below:

**Example 5**

A customer in Europe wanted to reduce zinc oxide from 5.5% to less than 2.5% in an alkyd coating.

Coating	Test/Hours	Film Thickness	Scribe Corrosion	Non-Scribe Corrosion
5.5%.Zinc Phosphate	Salt Spray/240	50µ	9	9
2.47% Zn. Phos. + 2% M-5365	Salt Spray/240	50µ	8	9
2% M-5365	Salt Spray/240	57.5µ	9	8

In this case, Cortec® was not only able to reduce to zinc phosphate to below 2.5%, but also eliminated it completely with M-5365 without significantly reducing salt spray resistance.

**Example 6**

A U.S. customer wanted to eliminate modified zinc phosphate in an alkyd coating with one containing a Cortec® corrosion inhibitor.

Coating	Test/Hours	Film Thickness	Scribe Corrosion	Non-Scribe Corrosion
Mod. Zn Phosphate	Salt Spray/460	47µ	7	8
4% M-5365	Salt Spray/460	45µ	9	7

Cortec's M-5365 was superior to the modified zinc phosphate. However, the level of M-5365 had to be increased to 4%.

**Summary:**

In general Cortec® additives perform very well against zinc phosphate and modified zinc phosphate corrosion inhibitors. They can also be used in clear coatings, whereas zinc phosphate causes the coating to haze. In most cases, the optimum level of Cortec® corrosion inhibitor was not determined and even better results could be obtained by running a ladder study or a designed experiment.

Scribe Corrosion (millimeters creep from scribe)	
Millimeters	Rating
0	10
0 to 0.5	9
0.5 to 1.0	8
1.0 to 2.0	7
2.0 to 3.0	6

Non-Scribe Corrosion	
Area Failed %	Rating
0	10
0 to 1	9
2 to 3	8
4 to 6	7
7 to 10	6
11 to 20	5
21 to 30	4
31 to 40	3
41 to 55	2

**This is Your Newsletter!**  
What would you like to see in the next Leading Edge?

If you have suggestions please let us know. Call, write, fax, or e-mail us with your ideas.

**Happy New Year, Everyone!**



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