

Laboratory Developments

By Art Ahlbrecht

Vice President of Research and Development

The year just completed has been an exciting and fruitful year for our laboratory projects. We have developed new products with new technologies and with the addition of the advanced coating plant at Eau Claire new coated contributions are under-way.

Eco Film™

A biodegradable film with many new applications has been an exciting development this year. Several interesting modifications of it are underway for specific needs.

MCI® Fibers, *Patent Pending*

A process for making fibers containing MCI® building blocks has been worked out and new fibers are available. We have started a concrete research project to determine if the fibers can provide a long-term source of MCI® at the concrete rebar interface. The new technology will be displayed at the World of Concrete Show, in Las Vegas .

Customers with Opportunities

Distributors world-wide are in constant communication with us as they describe customer needs. Three exciting opportunities that developed from this interaction are as follows:

NASA Corrosion Problem

Cortec was visited in early December by engineers from the United Space Alliance based at Cape Canaveral who needed our assistance in dealing with corrosion on aluminum frames that were dropped from the space shuttle into the ocean. The project is underway with Brian Wuertz leading our effort.

Oil Field Project

As a result of a contact made with a Norwegian drilling fluid company by our friends and partners at Presserv in October, a new environmentally friendly inhibitor system has been developed. This system has been tested and a joint patent application has been filed. The Norwegian company and Cortec intend to present a paper in February describing the new system.

Prudhoe Bay

Cliff Cracauer spent three days in Alaska in December investigating corrosion in oil pipelines. He found that corrosion was present in the interface under the foam used between the inner and outer pipes. We have the system in the laboratory and are working on a solution to the present problem. It also offers an opportunity to develop products to prevent the corrosion problem from developing.

NASA Cathodic Protection Coating

Cortec has become a licensee of a concrete coating developed and tested by NASA. The coating utilizes metal powders in a silicate formulation. This new product will also be displayed at World of Concrete. We will be able to utilize NASA literature and test data to assist in the marketing of the product.

New Products

By Margarita Kharshan

Laboratory Director

2002 was one of the most arduous and successful years for Cortec and our laboratory team as well. We were very busy this year, working on the testing requests from distributors and customers, developing new products, creating technical documentation and providing customer support.

As a result, more than 300 technical test reports were issued, more than 25 new products were developed and more than 70 new Product Data Sheets were created.

We are proud to say that the sales of the products introduced in the last 3-4 years amounted to 37% of the 2002 total sales. We would like to thank all of you for your dedication and hard work.

We are introducing 9 new products in this newsletter that cover a wide range of applications and means of delivery. They are readily available for sampling and sale. As we develop new technologies that combine performance and environmental responsibility, we also consider real-world factors such as ease-of-use and cost.

Green Corrosion Inhibitors for Crude Oil Pipelines

VpCI®-629 Bio, *Patent Pending*

Working closely with our customers from North Sea, we developed a new, non-toxic chemistry that does not sacrifice performance. In fact, the new technology outperforms the toxic inhibitors, but exceeds all North Sea environmental requirements.

The new product Cortec VpCI® -629 Bio belongs to the new generation of inhibitors for pipelines that combine excellent protection in aggressive crude oil (media water with brines, carbon dioxide (CO₂), hydrogen sulfide (H₂S), etc) with “green” profile.

Traditionally, Cortec’s products for protection of equipment in the oil field (VpCI® -629, VpCI® -639) are very effective. Based on data from independent laboratories, our existing products outperform competitors’ products in corrosion protection and other important properties.

The need of additional product appeared when locations such as North Sea, US Western Gulf Coast Outer Continental Shelf, US Eastern Gulf Coast OCS, Eastern Canada and also “Trinidad and Tobago” specified their criteria of environmental acceptance in a given region.

Cortec’s VpCI® -629 Bio meets these criteria and has significant advantages in comparison to other products on the market.

- VpCI® -629 Bio is a biodegradable product
- Toxicity of VpCI® -629 Bio (LC50 and LD50) is hundreds times lower than conventional products
- The level of corrosion protection, provided by VpCI® -629 Bio is much higher than the data reported in the latest publications for the best competitors products.

In addition to performing ASTM and NACE recommended tests on VpCI® -629 Bio, Cortec acquired dynamic loop testing

equipment. The equipment can simulate the most severe conditions for pipelines: high-pressures, temperatures, circulating rates, high concentration of H₂S and acidity. VpCI®-629 Bio showed excellent corrosion protection when tested under these conditions.

The application of VpCI® -629 Bio is very similar to VpCI® -629 and VpCI® -639. It can be used in the well or collector and in the pipes transporting crude oil. The dosage levels for these products are in line with industry standards 5-10 ppm based on flow conditions.

VpCI® -629 Bio inhibits corrosion as well or better than most competitor products, and can be used in regions with strict environmental regulations. Beyond the legal requirements, using green inhibitors also show environmental awareness and concern.

EcoClean® Dispersant 600

Very few products exist that can clean-up oil spills. Cortec’s EcoClean Dispersant 600 is a biodegradable, non-toxic dispersant-emulsifier that allows a more cost effective and efficient method of clean-up.

EcoClean Dispersant 600 has the hydrophilic-hydrophobic balance, which enables this unique product to be emulsified in water and dispersed in oil. When EcoClean Dispersant 600 is incorporated in an oil-water mixture, it prevents the oil from forming a film on the water surface by breaking the oil in 500-700 µm size separate droplets (micelles). These separated micelles disperse in the water and do not affect the oxygen/air exchange on the water-air interface.

In comparison to many other conventional dispersant-emulsifiers EcoClean Dispersant 600 is very environmentally friendly, vegetable oil-based and doesn’t negatively affect sea life.



In November of 2002 the oil tanker *Prestige* sank off of the coast of Spain contaminating much of the valuable shoreline.

New Generation of Admixtures for Concrete

MCI® -2008 Via Corr™ – Additive for Self-Compacting Concrete, *Patent Pending*

When trying to describe the effects new-generation high-range water-reducing admixtures have on fresh concrete, one is tempted to say, “You’ve got to see it to believe it”.

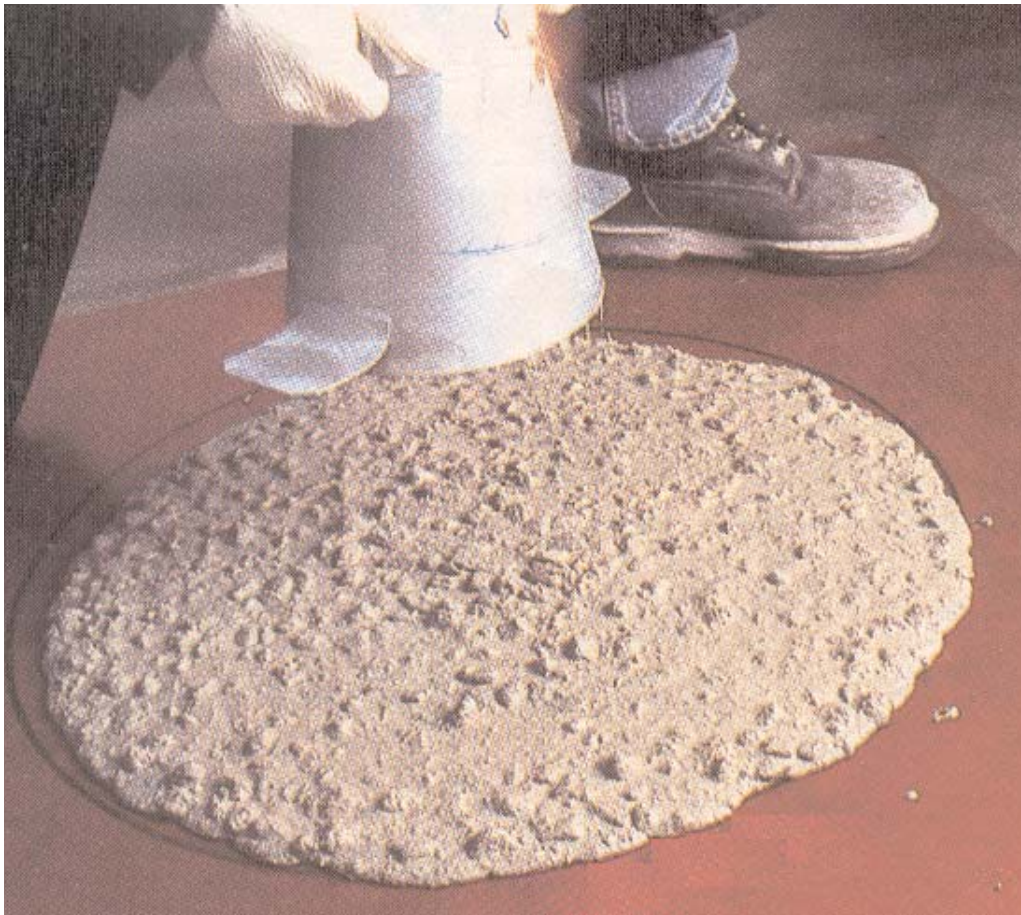
Self-leveling (self consolidating) concrete today is the hottest subject in the concrete industry. Some contractors will tell you that self-compacting (self-leveling) concrete has been around “as long as the water hose has been around. Put enough water into any concrete mixture and you will get a self-leveling result”. However, self-leveling concrete is not just concrete with an excessive amount of water. Most of these concretes actually have less water than standard mix designs, but they still have better fluidity than achieved with conventional water reducing superplasticizers.

Cortec has now developed a new concrete admixture that provides water-reducing properties and corrosion inhibition to self-leveling concrete.

MCI® -2008 concrete additive combines Cortec’s exclusive Migratory Corrosion Inhibiting™ technology with next generation superplasticizers – polycarboxylate-based superplasticizing viscosity modifiers.

MCI® -2008 Via Corr™ brings a lot of advantages to civil engineers. Everyone realizes that the main goal of this industry is to build high quality structures, economically. No additive will satisfy these requirements better than MCI®-2008. The unique properties of MCI®-2008 include:

- MCI®-2008 provides extremely high flowability and workability of concrete mix. Concrete mixes containing MCI®-2008 act like a liquid and spreads ‘flat’ on the floor when released from the cone. If one makes a knife cut on this concrete even after 45 minutes, you will not find the trace of this cut after it has cured.
- Economical aspect: use of MCI®-2008 admixture allows the civil engineers to reduce manpower for placing and compacting the concrete, reduces construction time, lowers equipment cost. Additionally, MCI®-2008 gives concrete mixes the ability to fill complex forms and members with congested reinforcement, and eliminates the rubbing and patching usually required to fill defects in poorly consolidated surfaces.
- MCI® -2008 provides substantial (18-30%) water reduction in concrete mix designs. It gives the customer the possibility to obtain strong durable concrete with a favorable porous structure.
- MCI® -2008 is a very effective migratory corrosion inhibitor for long term durability. And this is not all. MCI® -2008 is very environmentally friendly by chemical nature, provides self-leveling in a variety of mix designs, etc.



MCI®-2008 combines MCI technology with a new generation of superplasticizers

Based on modern technologies, MCI® -2008 is one of the best products on the self-leveling admixture market today. Domestic and foreign patents have been applied for.

MCI®-2007 Super Corr™ in Powder Form

The well known MCI® -2007 Super Corr is Cortec’s patented product which combines Cortec’s exclusive Migratory Corrosion Inhibitor™ technology with water-reducing properties in one unique admixture.

MCI® -2007 Super Corr was available only in the liquid form. But for some applications it is more convenient to use product in powder form, if the same properties are kept.

MCI® -2007 Powder corrosion inhibiting superplasticizer was developed to add the admixture to concrete in the powder form. It gives civil engineers a very power-

ful tool to build structures with much longer service lives than those utilizing conventional superplasticizers.

A large number of concrete structures are suffering from the corrosion of reinforcement caused by deterioration of concrete. MCI®-2007 Powder enhances durability by:

- Acting as a superplasticizer it significantly reduces the amount of water necessary to obtain sufficient workability of concrete mix. By reducing the amount of water in concrete mix it lowers permeability to aggressive ions, such as chloride (Cl-).
- The water reduction provided by this admixture exceeds 30%.
- Powerful combination of contact and migrating corrosion inhibitors protects embedded rebar. These film-forming inhibitors passivate rebar by chemical adsorption and provides very effective, long-term protection.
- MCI® -2007 Powder is 100% active and very economical.

Non-Flammable Protector for Electronics

ElectriCorr® VpCI®-248

ElectriCorr® VpCI®-248 is a modification of our best selling electronics protector ElectriCorr® VpCI®-238. This new product, containing the same inhibiting package as a VpCI®-238

offers a new possibility for electronic applications where the level of VOC (Volatile Organic Compounds) or flammability/combustibility is regulated.



ElectriCorr® VpCI®-248 is thermally stable, non-flammable and contains as a carrier environmentally sensible fluorocarbon solvents, which are exempt from VOC regulations by the US EPA. This blend of solvents dries fast by leaving on the surface a very thin protective film effective against aggressive environment, such as industrial, marine and tropical climates.

ElectriCorr® VpCI®-248 contains an effective formulation that prevents

galvanic corrosion of metals and alloys found in electronic applications, such as aluminum, copper, nickel and silver plating, etc.

In addition to being non-flammable, ElectriCorr® VpCI®-248 is free of 1,1,1 – trichlorethane and other harmful solvents.

ElectriCorr® VpCI®-248 serves multiple functions: it is an excellent solvent-based non-flammable cleaner for electrical parts and compounds, electrical motors and circuit boards. This product can also be used as a defluxing agent by leaving corrosion protection behind. In addition, ElectriCorr® VpCI® -248 is recommended as a solvent-based rust preventative for long-term multimetal protection in highly humid atmosphere.

Coatings in the News

Non-Tacky Temporary Coating VpCI®-391

Our customers who used VpCI®-389, liked the outdoor protection properties provided by this product.

As a water-based emulsion, VpCI® -389 leaves a slightly tacky film on the metal surface that for some applications looks very attractive. For applications requiring non-tacky temporary coating for outdoor protection equal to VpCI®-389, we are pleased to announce VpCI®-391.

VpCI®-391 is a water-borne, non-tacky temporary coating intended for medium to long-term outdoor protection. Once dried, VpCI®-391 builds a non-tacky, transparent film on the metal surface that provides excellent salt, humidity and UV resistance.

This product is a complex mixture of non-toxic organic inhibitors, incorporated in a water-based acrylic polymer with excellent adhesion to marginally prepared surfaces.



VpCI®-391 protects exposed metals from the elements.

Test Data (SAE 1010 Carbon Steel)

Test Method	Thickness of Coating (mils/microns, DFT)	Time of Protection (hours)
Salt Spray (ASTM B-117)	0.5/12.5	140
	1.0/25	250
	2.0/50	600
Humidity (ASTM D-1748)	1/25	1400
	1/50	1500+

Ease of removability of VpCI® -391 from metal surfaces (hot water blasting or use of VpCI®-417) is one of the very important advantages of this product in comparison to permanent coatings. In addition, this coating is clear or can be supplied in a variety of colors.

Excellent corrosion protection in different environments, tack-free film, ease of removability, availability in different colors, cost-effectiveness, and excellent environmental profile makes this product superior to other temporary coatings on the market.

VpCI® -396 Modification

Cortec's VpCI® -396 (single component package of moisture cure urethane) is a very popular coating for applications in severe environments. This product showed excellent protection by forming a very hard but flexible coating that cures in the presence of moisture in the air.

Historically, products of the same nature (based on polyurethanes) contain some aromatic solvents. We have removed these harmful solvents from VpCI® -396. In our new formulation, we use butyl acetate as a cosolvent, which considerably improves the environmental profile of VpCI® -396.

In addition, the tendency for VpCI® -396 to settle has been significantly reduced by the use of a new solvent. It will not require much time to mix before use. The exceptional corrosion, solvent and acid resistance, extreme hardness and flexibility are some of the properties of this unique product.

MilCorr® Improved Construction

MilCorr VpCI® Shrink film is a product reaching worldwide markets due to the growing number of shrink film wrapping applications. These applications include military vehicles and equipment preservation, recreational vehicles (boats, snowmobiles, etc) and pallet shrouds. Placing MilCorr VpCI® Shrink film completely around the item and then placing the item into a heat-oven, or by using a mobile heat gun, is all that is required for long term (up to 5 years) protection in most aggressive climates.

MilCorr VpCI® Shrink film offers the following advantages: fire retardant, contact and vapor phase corrosion protection for multimetals (steel, cast iron, brass copper, solder, aluminum, silver and nickel), and extra mechanical strength and resistance to puncturing and tearing. In addition, MilCorr® contains fire retardant and UV inhibitor additive packages not found in common shrink films on the market today.



MilCorr VpCI® Shrink Film keeps valuable military equipment free of corrosion.

Surlyn-Based Cor-Pak® Skin Film

Cor-Pak® VpCI® Skin film has recently undergone a modification to reflect the industry standards in skin film technology.



Cor-Pak® Skin Film now contains Surlyn as it's base resin.

and corrosion inhibition on metals such as carbon steel, cast iron, nickel, solder, aluminum and silver is a must.

Advantages of Cor-Pak® VpCI® Skin film include immobilizing product for ease of handling and shipment, reducing product deterioration, superior toughness, ease of inspection, no cleaning needed after packaging. In addition, further processing such

as welding, soldering or painting of the item is not hindered after packaged with our film. In essence, Cor-Pak® VpCI® Skin film leaves the exposed metal surface clean and free of contamination.

Due to the popularity and quality of DuPont® Surlyn resins, Cor-Pak® VpCI® Skin film will now use Surlyn, as it's base resin.

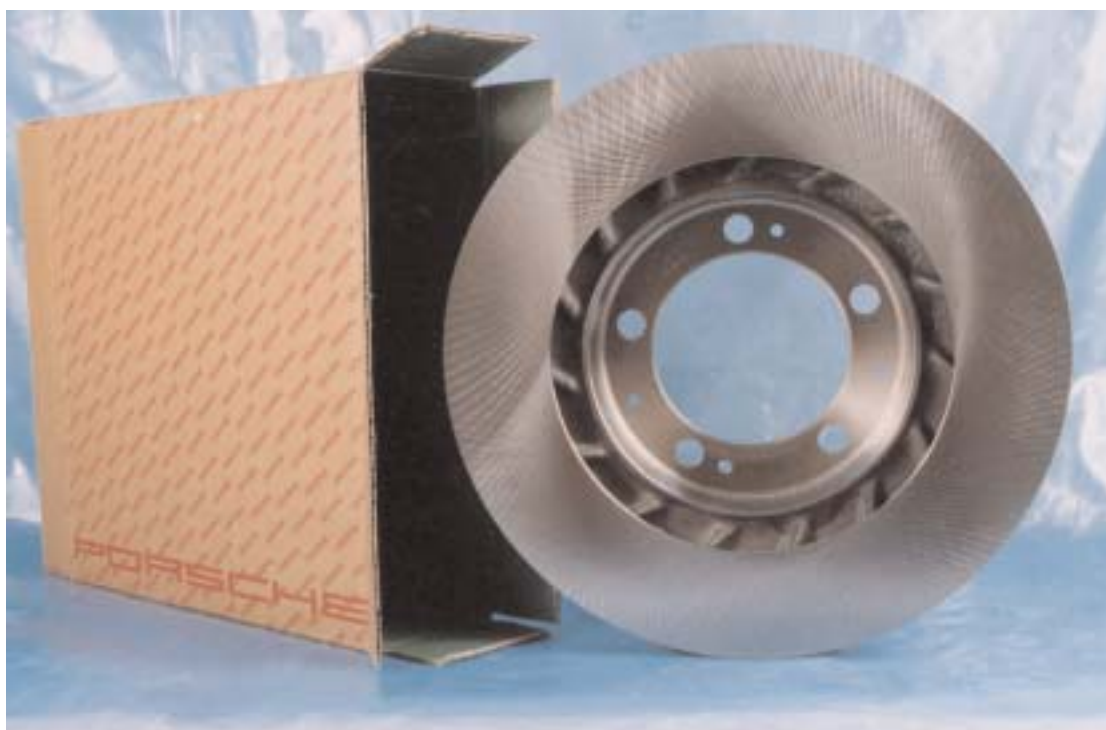
Surlyn, which is composed of ethylene acid copolymers, offers the ultimate in melt strength, toughness and clarity. The crystal clear appearance of this product, make it ideal for retail display packaging as well as for any application where crystal clear appearance

Cor-Pak® VpCI® Linerboard

Cortec® Cor-Pak® linerboard is the premium corrosion inhibiting linerboard in the industry, providing contact, barrier and vapor phase corrosion inhibition for multimetals. Cor-Pak® linerboard is fully recyclable/repulpable, environmentally safe, nontoxic, biodegradable, and does not contain nitrites, phosphates, silicates or other hazardous compounds.

Cor-Pak® linerboard is made from the highest quality neutral natural kraft linerboard, without the use of chlorine or other chemical bleaching, which is often found in competitor corrosion inhibiting linerboards. The vapor phase corrosion inhibitor coating on the liner board vaporizes, reaching all neutral surfaces forming a thin protective layer that does not need to be removed and will provide long term corrosion inhibition. Cor-Pak® linerboard can be produced in a corrugated box form, end closures for shipping tubes, insert strips for recessed areas in large packages, sheet liners or separators between products and produced in custom sizes to be placed into void spaces of packaging containers.

Cor-Pak® VpCI® Linerboard is produced in our Eau Claire, Wisconsin coating plant.



Automotive disc brakes packed in corrugated board produced with Cor-Pak® VpCI® Linerboard.



Cortec Laboratory's dedicated team of chemists and engineers.

*Questions & Answers
By Bob Berg, Packaging Specialist*

COMMON QUESTIONS OFTEN ASKED ABOUT Eco Film™ and Eco-Corr®

What is biodegradation, compostability of films and what determines if Eco Film™ and Eco-Corr® are biodegradable and compostable?

If degradation results from the action of naturally occurring microorganisms, such as bacteria or fungi, then the material can be considered biodegradable. There can be various levels of biodegradability, so it is necessary for standards to be set with respect to the rate and amount of biodegradation. ASTM D 5338 is the industry standard with respect to biodegradation of films, specifying requirements that must be met in order for the film in question to be labeled as a biodegradable film. Eco Film™ and Eco-Corr® conform to the testing result requirements of ASTM D 5338.

A material that undergoes degradation by biological processes during composting to yield carbon dioxide, water, inorganic compounds at a rate consistent with other known compostable materials and leave no visible, distinguishable or toxic residue, then the material is considered to be compostable.

ASTM D6400-99 is the industry standard with respect to compostability of films, specifying requirements that must be met in order for the film in question to be labeled as a compostable film. This particular test method requires that 60% of the organic carbon must be converted to carbon dioxide within 180 days. EcoFilm and Eco-Corr® conform to the testing result requirements of D6400-99.

When will Eco Film™ and Eco-Corr® start to Biodegrade, become compostable and what is the process of biodegrading and composting?

Taking a sample of Eco Film™ or Eco-Corr® and placing them into soil, roughly about a foot down (33cm), you can expect these two products to completely disintegrate in 5 to 7 weeks, depending on the conditions in the soil. Placing EcoFilm or Eco-Corr® into Decayed organic matter, otherwise known as compost, you can expect the same time frame of 5 to 7 weeks for complete degradation, depending on conditions in the compost. The process of biodegradation and composting is exactly the same. The transfer of heat in these two different environments will cause the breaking of the polymer chains, which make up both of the products. Microorganisms, such as bacteria and fungi will then devour the many links and in time transfer to carbon dioxide and water.

What are the applications, advantages of using and future products involving Eco Film™ and Eco-Corr®?

Applications of Eco Film™ involve garbage bags, yard waste, grocery bags. Eco-Corr® applications involve packaging of multimetal components. Eco Film™ offers the advantages of being extremely durable with respect to puncture resistance, tear resistance. EcoFilm also will degrade completely within weeks leaving no trace in landfills. Eco-Corr® offers the advantages of being a multimetal corrosion inhibitor and offering vapor phase corrosion inhibition, contact corrosion inhibition and barrier corrosion inhibition along with the mechanical properties of Eco Film™. Eco-Corr® also will biodegrade completely within weeks leaving no residue. Soon to be in the 100% biodegradable/compostable line of packaging films from Cortec Corporation, is an anti-stat film, cling film, stretch film, and bubble film.

We are proud to announce that the prestigious Materials Performance magazine has added a special supplement highlighting Cortec's products and technologies to its next issue. Cortec is only the 3rd company in the world to receive this honor. Materials Performance is published by the National Association of Corrosion Engineers (NACE) and is the world's largest circulation magazine dedicated exclusively to corrosion prevention and control. 28,000 copies will be distributed to subscribing corrosion engineers around the globe. Copies of Materials Performance will also be available at the upcoming NACE trade show in March.

Have a fun and Happy New Year!

Featured in the next Leading Edge:

- Biodegradable antiscalant
- Additives to drilling fluids
- Adhesive-containing packaging materials
- New surface preparation products, etc



4119 White Bear Parkway, St. Paul, MN 55110 USA
Phone (651) 429-1100, Fax (651) 429-1122
Toll Free (800) 4-CORTEC, E-mail info@cortecvci.com
Internet <http://www.cortecvci.com>

Cortec®, Corr-Mitt™, EcoAir™, Eco-Corr®, Eco Emitter™, EcoLine™, EcoSpray®, EcoClean®, EcoShield™, EcoWeave®, MCI®, Cor-Lube™, Cor-Mastic™, Cor-Pak®, CorShield®, Corrosorb™, CorCrete™, Corwipe®, EcoCoat™, ElectriCorr®, MCI®Grenade®, Migrating Corrosion Inhibitors™, Migratory Corrosion Inhibitors™, Primecoat™, Total Corrosion Control™, VpCI®, VpCI CorVerter™, VpCI Film Color of Blue™ and HPRS™ are trademarks of Cortec Corporation.
©Cortec Corporation 2003. All rights reserved.



Certificate No. 70781

Certificate No. 81867