

Environmentally friendly corrosion treatments offer versatile solutions to pipe and tubing corrosion

By Julie Holmquist, content writer at Cortec Corporation

Cortec Corporation offers a variety of innovative products, for corrosion prevention and removal, that rely heavily on environmentally friendly technology and are relatively easy to use and dispose of. By implementing a few preventive steps, both manufacturers and end users can avoid many of the headaches that come from corroded piping of all kinds.

Pipes come in all sizes and varieties: millimetres to metres wide, straight or coiled, smooth or corrugated, welded and seamless, in multiple types of metal. A large portion of these metal pipes are at risk of corrosion before they are ever used. Storage and shipment are some of the most critical stages, when pipes are often exposed to corrosive conditions. The potential impacts are high claims for returned goods and lost time for installation. To avoid these problems, corrosion prevention strategies can be implemented, when possible, and restoration can be performed, when needed.

VpCI technology

Many of these solutions include the use of innovative vapour phase corrosion inhibitor (VpCI) technology, which can be embedded in a variety of materials. VpCI molecules vaporise from a source material to fill an enclosed space until they reach equilibrium.

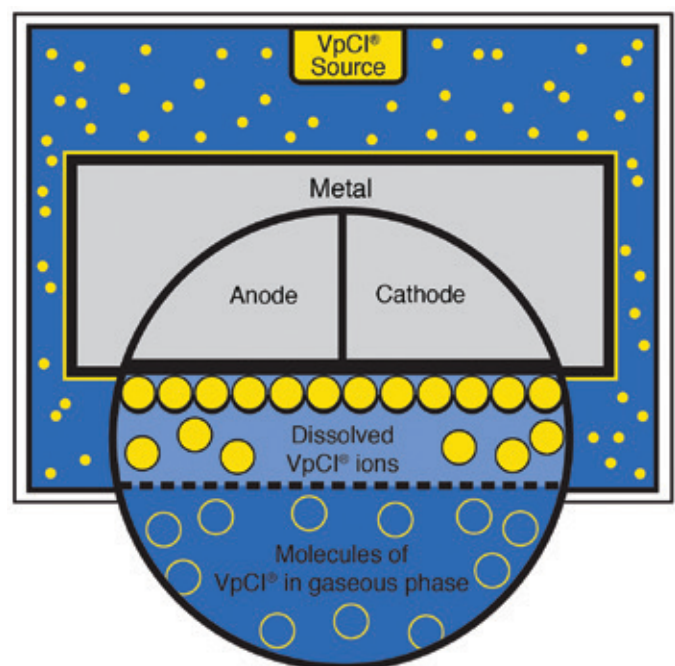
The molecules adsorb on metal surfaces within the space to form a protective monomolecular barrier against corrosive elements such as moisture. If a breach is made in the surface of this protective barrier, other VpCI molecules in the space will flow in to fill the void.

When the enclosed space is opened, the VpCI molecules will evaporate off the metal surfaces, leaving them clean, corrosion free and ready to use.

VpCIs have the advantage of working in multiple phases. This allows them to be used in a combination of dry or wet conditions, making them suitable for pipe internals with fluctuating environments.

For example, VpCIs dissolved in a partially filled bottle of water with a piece of steel wool inserted will protect the portion of the metal in the water, above the water, and at the air-water interface (a traditionally challenging area to protect).

VpCIs can be combined with many different properties for water treatment, packaging and coatings, all of which can be used for different phases of a pipe's life cycle.



VpCI molecules evaporate from a source material to fill an enclosed space, condensing on metal surfaces to form a protective barrier from corrosion

Image credit: Cortec Corporation



Water in the left bottle was treated with VpCI, which protected the steel wool in liquid and vapour phase, as well as at the air-water interface. The right bottle was untreated

Image credit: Cortec Corporation

Hydrostatic testing

Often, pipes must be hydro tested to check for leakage before installation or commissioning (eg pipe skids, boiler tubes or pipelines). Once the water is run through the tubing, it is difficult or impossible to completely remove the moisture trapped inside.

This residual moisture often results in build-up of corrosive by-products. To protect against this, it is important and much simpler to implement corrosion inhibitors directly into the hydro testing water. It is also important to choose a corrosion inhibitor that is safe to dispose of with the water.

VpCI-649 (or a similar water treatment product) is a choice for adding to hydro testing waters in both ferrous and non-ferrous metal tubes and piping. Based on organic components, the liquid is non-toxic and free of nitrites or phosphates, making it safe to use and environmentally friendly to dispose of.

Because it includes a combination of contact and vapour phase corrosion inhibitors, it offers thorough protection both of pipe surfaces covered with water and void spaces where the water does not reach.

Once the hydro testing is completed, the empty pipes can be further protected with a variety of other VpCI technologies to preserve them from corrosion while they are awaiting use.

Protecting pipes during storage or shipping

Whether or not hydro testing is conducted, it is important to preserve empty pipes during shipping and storage. This is highly critical to protecting the manufacturing company from losses as a result of rust-damaged goods, as well as protecting end users from unpleasant surprises, lost resources, and lost time when they go to install pipes that they find to be corroded.

A variety of methods and materials are available in such cases, and they can be tailored to specific pipe sizes, constructions, and other specific needs. One of the simplest methods for bundles of narrow tubes, such as copper piping, heat exchanger tubes or HRSG pipes, is the use of VpCI paper or film.

For example, coated VpCI papers can be wrapped around coils of dry tubing for protection during shipping. The paper's coating is faced toward the metal inside the package to allow release of the VpCI molecules into the enclosed space. (This is also useful for the protection of raw materials such as bar stock.)

Options include CorShield VpCI-146 Reinforced Paper, for stronger protection of sharp materials or those likely to cause puncture, and recyclable moisture barrier and grease-resistant VpCI papers such as VpCI-144 Super Barrier and VpCI-148, respectively.

Coated papers are compatible with a variety of ferrous and non-ferrous metals, eliminating the need to stock different papers for different metal substrates.



Another option often used for shipping or storage of metal parts is VpCI-126, a recyclable film that can be combined with UV-resistant or fire-retardant properties, if desired.

The film can be shrink-wrapped around a bundle of smaller pipes or used to end-cap large diameter pipes internally fogged with VpCI.

It can also be made into a variety of bag formats for shipping or storage of metal parts.

Depending on the amount of protection desired, an additional source of VpCI, such as foam padding, can be placed inside the package for extra corrosion protection of void spaces.

Large pipes or piping systems typically benefit from fogging with a powder or waterborne corrosion inhibitor.

The waterborne vapour corrosion inhibitor is often used for protection of large diameter oil and gas pipe internals such as those awaiting installation in pipe yards.

The inhibitor leaves a thin, environmentally friendly, self-healing film on the internal surface of the pipes and provides an alternative to dangerous and sometimes unreliable nitrogen blanketing. After fogging, the pipes can be end-capped with VpCI film to trap the protective VpCI fog inside.

For large pipe exteriors, VpCI removable coatings can be used with low impact on the environment. This is an especially helpful option for pipe couplings that need welding out in the field.

Welding requires a clean surface, and the use of water-based VpCI coatings allows the welder to simply rinse the coated pipe couplings to expose a clean pipe surface for welding, with no need for abrasion.

When restoration is needed

Sometimes preventive steps are too late because corrosion has already started to deteriorate pipe internals or externals. In these cases, all is not lost, as restoration has been repeatedly effective with the use of organic rust removers, such as VpCI-422.

This is a non-flammable, bio-based and biodegradable rust remover that typically does not require special disposal. It can be sprayed on corroded pipes, allowed to sit, and then washed off and the surface neutralised with a water-based alkaline cleaner-degreaser (eg VpCI-416).

Once the piping is restored, it should then be preserved according to normal VpCI storage and shipping strategies to ensure continued protection.



LNG pipes were end-capped with VpCI-126 film after internal fogging with VpCI. (Cortec Case History 311)

Conclusion

Corrosion protection of pipes and tubing can be challenging due to their design and function. The use of versatile VpCIs for corrosion inhibition is an excellent solution, thanks to VpCI adaptability, effectiveness and environmentally friendly options.

Acknowledgements

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