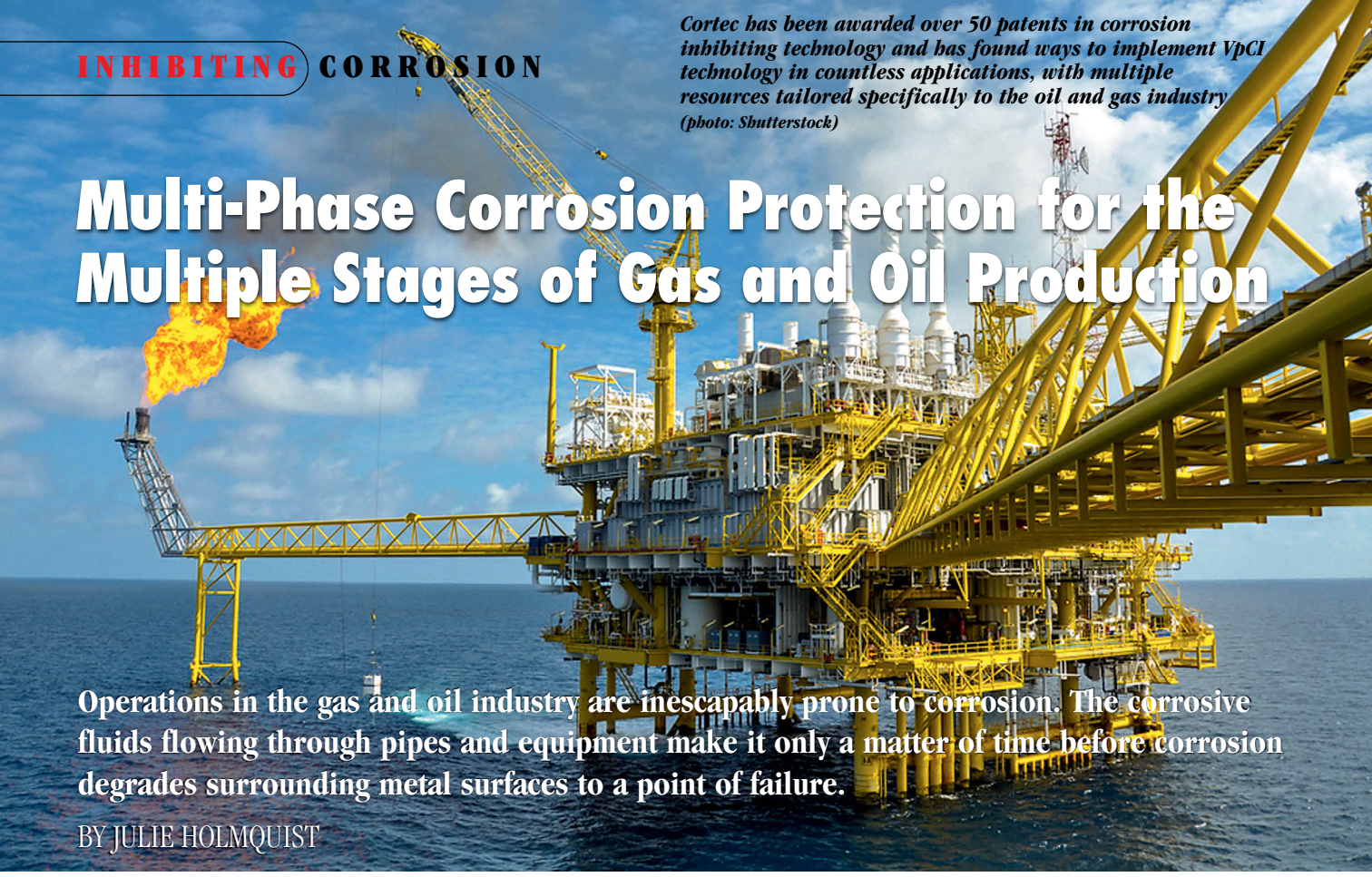


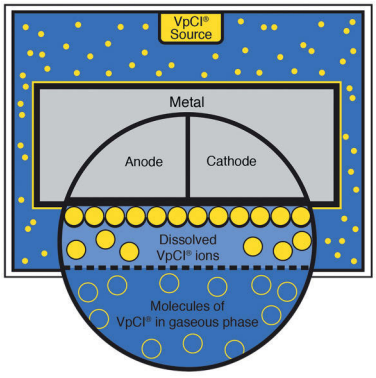
Cortec has been awarded over 50 patents in corrosion inhibiting technology and has found ways to implement VpCI technology in countless applications, with multiple resources tailored specifically to the oil and gas industry (photo: Shutterstock)

Multi-Phase Corrosion Protection for the Multiple Stages of Gas and Oil Production

Operations in the gas and oil industry are inescapably prone to corrosion. The corrosive fluids flowing through pipes and equipment make it only a matter of time before corrosion degrades surrounding metal surfaces to a point of failure.

BY JULIE HOLMQUIST

Due to the volatile nature of petrochemicals, it is all the more critical to ensure that corrosion does not get to this point. Should a pipeline break, the subsequent leak could result in a fatal explosion, environmental contamination, and substantial remediation costs. Even if it is only a matter of equipment failure and unexpected downtime on a rig or refinery, the cost of corrosion in terms of lost production and assets can be enormous given the large scale of the industry.



How VpCI Works. VpCI molecules vaporise, disperse, and condense on metal surfaces inside an enclosed space to form a monomolecular protective layer against aggressive ions (illustrations: Cortec)

While pipeline corrosion protection is encouraged and even required in regions around the world, many companies are unaware of the full potential of multi-phase corrosion protection using Vapor phase Corrosion Inhibitor (VpCI) technology in all stages of gas and oil production.

Meeting Industry Corrosion Challenges

Over 35 years ago, Cortec Corporation began researching and developing VpCI technology. Since then, Cortec has been awarded over 50 patents in corrosion inhibiting technology and has found ways to implement VpCI technology in countless applications, with multiple resources tailored specifically to the oil and gas industry.

The largest petrochemical companies in the world have found Cortec to be a reliable source, not only for the provision of effective corrosion inhibiting products, but also for expert guidance and assistance in applying the technology.

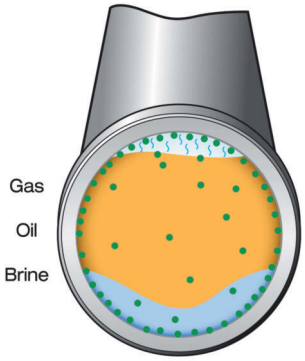
VpCI Technology

VpCI technology is a unique, environmentally friendly method of corrosion protection that has many advantages over traditional corrosion inhibitors. The basic mechanism consists of VpCI molecules vaporising and diffusing from a source material until they are evenly distributed throughout an enclosed space. These vapours condense on all metal surfaces in the space and form a monomolecular protective layer that physically adsorbs on metal.

This protective layer creates a microscopic, hydrophobic surface that safeguards the metal from the attack of aggressive ions otherwise able to corrode the metal. It can also neutralise the electrical surface potential of the metal to inhibit a corrosion initiation point from starting. Because of the vaporising and diffusing potential of the VpCI source, if a VpCI ion is somehow dislocated from the metal's surface, another VpCI molecule can move in to replace it.

Multi-Phase Protection

The vapour action of VpCI technology broadens the scope of typical corrosion protection capabilities. Traditional corrosion inhibitors are often limited by the ability to protect a metal surface only when applied directly to it. This opens the door for corrosion in hard to reach areas or on surfaces that may have been missed during the application of a corrosion inhibitor.



Pipeline section showing active VpCI protection in the interface, liquid phase, and vapor phase

In the case of a pipeline filled with a mixture of liquids and gases, a traditional liquid phase corrosion inhibitor would only protect the metal directly in contact with the fluid, while the empty headspace above the fluid would go unprotected and still be under attack from moisture (top of line corrosion). However, VpCI treatments designed for process industries like oil and gas can offer combined corrosion protection in both the liquid phase and vapor phase, as well as at the critical liquid-vapor interface. This allows for protection of a pipeline's entire internal surface.

Adapting to the Need

In addition to, and in conjunction with, these multi-phase properties, VpCI technology is adaptable to many different applications and can be combined with multiple features for greater versatility. This allows the application of VpCI technology in both fluid systems and dry metal storage. For example, VpCIs can be injected directly into a pipeline system, included in machine lubricants, or incorporated into film to wrap around equipment for easy protection during storage.

VpCI permanent and temporary coatings add to the range of options for adapting to the need at hand. This versatility makes VpCI technology useful in upstream, midstream, and downstream processes in stages ranging from construction to operation, maintenance, and decommissioning.

Construction

When a rig, pipeline, or refinery is being built, chances are that some equipment will require preservation during storage or shipment. In terms of facility construction, it is not uncommon for important assets to sit unused at a new facility for a year or more before installation or plant commissioning. This gives oxygen and moisture ample opportunity to start the corrosion process. If allowed to run its course, corrosion will present an unwelcome surprise when it comes time to install the parts.
This could create significant financial loss in terms of degraded assets alone, which is even more devastating when those assets happen to be equipment requiring a 1- to 2-year lead time to replace. Corrosion like this would be a serious setback to launching facility operations. With adequate planning, VpCI technology helps the commissioning process get started on the right foot.

During pipeline construction, corrosion can begin on internal surfaces even before piping reaches the field. If pipe internals are inadequately protected, they can begin to corrode immediately after manufacturing. VpCI technology solves these challenges by making corrosion protection more effective and easier to apply in these difficult to reach internal spaces.

Operation and Maintenance

In some cases, putting equipment into operation only serves to exacerbate exposure to corrosive elements like crude oil and natural gas. By injecting VpCIs internally, metal pipes are protected more thoroughly during operation. The combination of vapor phase and film forming corrosion inhibitors injected into the fluid inside the pipe protect pipeline walls directly in contact with the fluid as well as void spaces where air and moisture fester.

VpCI can also be used during maintenance exercises such as hydro-testing. Whereas flushing a pipe or tank with plain fresh or saltwater would leave it damp and at risk for corrosion, adding VpCI technology to the hydro-test water offers protection during the testing process and beyond.

Protecting Critical and Operational Spares

Another beneficial operational practice is maintaining rust-free operational or critical spares; replacement parts that would be ready to go in case of critical equipment failure. The last thing that a facility wants is to find a replacement part unusable due to rust, meaning operational downtime must continue longer than expected while a new part is on order.

VpCI technology is useful in upstream, midstream, and downstream processes in stages ranging from construction to operation, maintenance, and decommissioning ***(photo: Shutterstock)***

Outer surfaces of an offshore platform top drive unit were washed with VpCI cleaner/degreaser and coated with a VpCI outdoor corrosion inhibitor before temporary storage on deck for one year ***(source: Cortec Case History 303)***

It is important to have an effective, yet easy-to-remove method in place to protect spare parts from deterioration. VpCI technology enables this kind of protection, which may simply require rinsing a protective coating off a part or unwrapping it from a protective VpCI film before the part is ready to install. VpCI rust removal can also be used to redeem parts that have already begun to degrade. In this way, warehouses full of expensive assets can be rescued from significant loss.

Plant Layup and Decommissioning

Similar VpCI processes are available for putting an oil or gas facility into short or long-term storage. The aim is to preserve a partial or entire facility in such a condition that it can be restarted with very little time and effort. A number of offshore rigs have benefited by using VpCI technology during temporary storage of equipment in corrosive conditions on deck.

When it came time to put the equipment back in service,

DC Motors on a mud pump were protected with VpCI foam and film during temporary lay-up on an offshore rig in the Mediterranean *(source: Cortec Case History 303)*

removing VpCI technology from the protected equipment was easy. Even in cases where plants or facilities are being permanently closed, it is desirable to keep assets in resalable condition if possible. VpCI technology helps make this happen by protecting from rust in a more cost-effective way than most treatments.

Environmentally Friendly Methods

VpCI technology tends to be more environmentally friendly than other methods simply by its reduction of wasted resources. It is also less reliant on harmful chemicals. One staple VpCI product containing low toxicity levels was able to simply be released into the North Sea after being used for hydro-testing and protection of large pipe system internals. Many VpCI technology products can be easily captured and safely discarded without special permits required for hazardous waste disposal.

Preservation Potential

The multi-phase, multi-faceted nature of VpCI technology gives it incredible potential for preservation in all phases of the gas and oil life cycle. This can in turn create compounded savings in terms of asset preservation, reduced labor costs, diminished downtime, and safety. As awareness and implementation of VpCI technology increase, it is expected that losses due to corrosion will continue to drop. In the meantime, VpCI applications will likely find more ways to adapt to the multi-faceted needs of industries worldwide. ■

Acknowledgements

The author wishes to acknowledge the expert insights provided by James E. Holden, P.E., and Bob Boyle of Cortec Corporation from their experience in the oil and gas industry. Thanks also to Eric Uutala, Cortec Technical Service Manager, for additional input.

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