# Preserve and Protect

**Julie Holmquist, Cortec Corporation, outlines a simple and effective solution designed to protect idle cement plant equipment from corrosion.**

The construction of a cement plant is a huge undertaking in terms of planning, financing, and execution. As with any large project, it takes a while for everything to come together. This may mean that new equipment like ball mills or vertical mills, hydraulic power packs or mill brakes arrive onsite before the plant is ready to start up. In the meantime, the equipment may sit exposed to harsh environments, leading to corrosion before the equipment even comes online. Assets can be at a similar risk of corrosion during a plant shutdown and may require repair or restoration before re-sale or startup if not properly protected. The good news is that there are simple and effective ways to preserve assets in the interim without requiring a lot of monitoring or preparation to bring them online quickly.

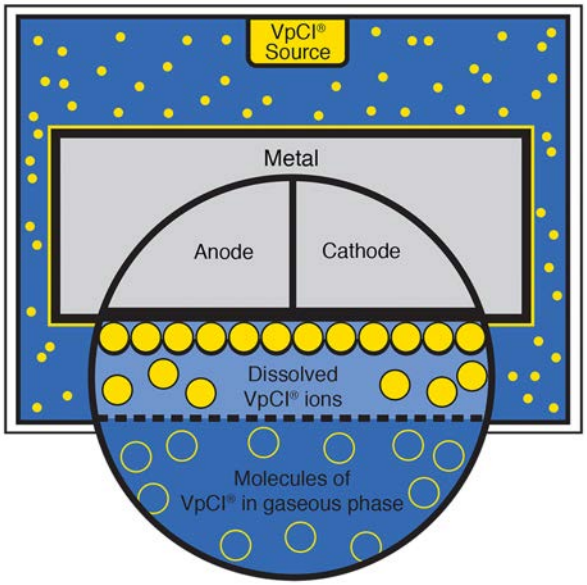


**Illustration of how Vapour phase Corrosion Inhibitor technology forms a protective molecular layer on metals in an enclosed space. Image courtesy: Cortec Corporation.**


**VpCI Emitter cups are a great way to protect the insides of electrical boxes from corrosion. Images courtesy: Cortec Corporation.**

Cortec Corporation specialises in asset preservation. The idea is to spend a fraction of an asset's cost in order to protect it from corrosion that could cause more problems and possibly even equipment failure down the road. Cortec's Vapour phase Corrosion Inhibitor technology (which falls under the VpCI brand name) is well suited for this purpose and presents a range of practical options for those needing to preserve high-value idle equipment.

## The big picture

Vapour phase Corrosion Inhibitors (VpCIs) belong to a class of corrosion inhibitors that easily sublimate from a solid to a vapour. The vapour action of these corrosion inhibitors makes them ideal for enclosed spaces, such as packages or the insides of large equipment voids. The VpCI molecules diffuse throughout an enclosed space until they reach their comfort zone in terms of molecular spacing – i.e., equilibrium. At this point, they turn to their next interest at hand – attaching (adsorbing) onto nearby metals.

When VpCIs are attracted to metal surfaces, they join other VpCIs to form an invisible molecular layer on the surface of the metal. This molecular layer interferes with the normal chemical oxidation and reduction reactions that occur when iron, oxygen, and water come into contact with each other to form a corrosion site that normally deteriorates the metal surface. Vapour-phase protection continues as long as the molecules are trapped in an enclosed space. When the enclosure is breached, the same volatilisation of VpCIs that made them diffuse in the first place causes them to travel to areas of lower concentration (i.e., outside the enclosure) according to Fick's law of diffusion.

There are two major advantages of Vapour phase Corrosion Inhibitor technology:

- It allows dry corrosion protection without having to spray or paint a coating or liquid rust preventative onto the metal surface. Often, when a traditional rust preventative is applied, it leaves a greasy film that has to be cleaned off later. This is messy and time consuming, not to mention the fact that this process often exposes workers to cleaning solvents or petroleum-based rust preventatives in the first place.
- It enables more thorough protection in hard-to-reach areas. This is especially important for equipment with complex internals where it would be difficult to apply a coating even if one were desired. Rather than relying on the thoroughness of the worker applying the material, VpCIs automatically find their way to less 'crowded' areas in the void until the molecules are evenly dispersed. This is an added advantage for equipment with tanks or

gearboxes that are partially filled with liquids. A standard contact corrosion inhibitor will only protect parts of the gearbox where the oil circulates. However, VpCIs are able to reach the overhead areas or sidewalls where the oil is not touching. One effect of this is to minimise the amount of oil or gas that needs to be left in the gearbox or fuel tank during transport or layup.

VpCIs can be applied using a variety of different mediums. Sometimes, they come in powder form packaged inside VpCI Emitter cups covered with a breathable membrane lid that allows the vapours to diffuse. A self-adhesive backing makes it easy to place emitter cups inside a small compartment, such as an electrical control box, to protect sensitive metal contact points. Other times, the VpCIs are packaged in breathable pouches or infused into foam material for protection of larger volumes.

VpCIs can also be incorporated into plastic film for packaging applications. The resulting VpCI films have turned out to be a convenient and effective option for outdoor storage of large equipment. They also work well in conjunction with VpCI Emitters, foams, and pouches. The films can be made more or less heavy-duty by adding UV resistant additives or using a greater film thickness depending on the expected duration or harshness of the environmental conditions.

## A closer look

After looking at the big picture of some technologies that can be used for corrosion protection, it is time to look at the details of where those materials can be applied to individual components. Ball mills and vertical mills used for cement grinding are large pieces of equipment that can benefit from overall protection. But they may also require special care for individual components. For instance, hydraulic power packs and brakes may have to be shipped from a manufacturer in one country to the end user in another country before being installed on the mills. In the meantime, these components may have to weather oversea conditions in a shipping container, followed by an indefinite storage period at the cement plant while everything is still getting set up.

In one specific example, hydraulic power packs and brakes for a SAG mill and ball mill (in this case for a mine, but very similar to cement grinding equipment) needed to be shipped from North America to South America in a marine container and then stored indefinitely for 8 – 10 months before it would be put into use. To preserve the equipment, the various components were shrink-wrapped in VpCI-126 Shrink Film of 6 mm (150 μm) before being packed in custom crating and shipped to the other side of the equator. In this manner, the components were preserved from the harsh conditions of the long haul and beyond.[1]

**Speciality components for a ball or SAG mill packaged for shipment to South America via marine container. Image courtesy: Cortec Case History 656.**

**Electronic equipment shrink-wrapped in VpCI-126 for protection during shipping and storage. Image courtesy: Cortec Case History 656.**

**Preparing to package hydraulic power packs for a ball or SAG mill. Image courtesy: Cortec Case History 656.**

The same type of preservation can be used to shrink-wrap an entire ball mill or vertical mill. VpCI pouches can be tied onto a cord and hung inside the barrel of the ball or vertical mill

**Preparing to package hydraulic power packs for a ball or SAG mill. Image courtesy: Cortec Case History 656.**

for internal protection that can easily be pulled out when the equipment needs to be started. For extra long-term protection in harsh outdoor conditions, MilCorr VpCI Shrink Film is an especially heavy-duty 'hurricane strength' VpCI film that can be shrink-wrapped around the outer surface of the equipment. VpCI-111 Emitters are also useful for placing inside electrical cabinets that control the equipment. Special corrosion inhibitor additives can additionally be added to the gearboxes, depending on the type of oil used.

## Startup advantages

When it is time to bring the equipment online, whether for initial commissioning or after a period of layup, it is relatively simple to prepare the equipment for operation. The steps can be as easy as removing the VpCI film and recycling it, pulling large VpCI pouches out of the equipment voids, and flushing the gearboxes. VpCI Emitters inside electrical compartments can stay where they are for ongoing protection during operation. Hence, there is generally little special cleaning or coating removal required.

## Conclusion

Cement plants rely on many large pieces of expensive equipment that can face indefinite periods of idle outdoor storage before initial startup or during temporary shutdown. It is important to have simple and effective corrosion protection strategies in place to make sure these assets are in good condition by the time they are needed. To get the best of both worlds, those technologies should also be user-friendly with minimal monitoring and little extra labour required before the equipment can be up and running. Vapour phase Corrosion Inhibitor technology makes this possible. ■

## References

1. 'Cortec Case History 656' – https://www.corteccasehistories.com/?s2member_file_download=access-s2member-level1/ch656.pdf