ASSET MANAGEMENT

Coastal tanks get lasting protection from atmospheric corrosion

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In the oil and gas industry, protecting massive carbon steel assets from corrosion is a continual challenge around the world, including China, particularly along coastline exposed to high humidity and salty air near oceans or other bodies of water.

The problem is worsened by the fact that many refineries and petrochemical facilities - including tanks and process equipment, as well as above ground pipeline and railcars - are located near ports to facilitate the storage and transport of both raw crude and processed products.

The typical preventive measure is to use barrier type coatings that are commonly reapplied every few years in these high-risk coastal areas. This can be costly and disruptive to oil and gas facility production, requiring blasting off the old coating, cleaning the surface, and reapplying multiple coatings. Despite this costly maintenance, excessive corrosion of such carbon steel assets can lead to leaks, fires and accidents, as well as accelerate premature replacement.

Now in these petrochemical coastal assets, an innovative coating approach is providing a long-term solution to fighting atmospheric corrosion, while minimizing production downtime and increasing safety.

The Chinese port city of Ningbo, bounded on the east by the East China Sea and on the north by Hangzhou Bay, has a very wet, humid climate, as well as salt laden air, that make the corrosion of petrochemical assets in the area a particular problem. For decades, the region has received an annual average of over 56 inches/1,440 mm of rain, along with over 157 precipitation days, and 80%+ average relative humidity - not to mention a monsoon season.

In these trying conditions, Ningbo Xingang Fuel Storage Company sought to protect its assets from corrosion. However, the corrosion on their carbon steel equipment is quite severe. The company faced a particular challenge in protecting two firewater cannons and the auxiliary fire lines on the east and west side of a 50,000 ton crude oil terminal located in the Beilun District of Ningbo.

Traditional methods of protection, such as applying polymer paints and rubber type coatings, have been ineffective and lose their effect soon after application.

While these methods can create a physical barrier to keep corrosion promoters such as water and oxygen away from steel substrates, this only works until the paint is scratched, chipped, or breached and corrosion promoters enter the gap between the substrate and coating. Then the coating can act like a greenhouse - trapping water, oxygen and other corrosion promoters - which allows the corrosion to spread.

Due to these harsh conditions the company looked for a better solution and turned to EonCoat, a spray applied inorganic coating from the Raleigh, North Carolina-based company of the same name, for use on a corrosion protection project to extend the life of the firewater cannons and auxiliary fire lines. EonCoat represents a new category of tough, Chemically Bonded Phosphate Ceramics (CBPCs) that can stop corrosion, ease application, and reduce production downtime.

In contrast to traditional polymer coatings that sit on top of the substrate, the corrosion resistant CBPC coating bonds through a chemical reaction with the substrate, and slight surface oxidation actually improves the reaction. An alloy layer is formed. This makes it impossible for corrosion promoters like oxygen and humidity to get behind the coating the way they can with ordinary paints.

Although traditional polymer coatings mechanically bond to substrates that have been extensively prepared, if gouged, moisture and oxygen will migrate under the coating's film from all sides of the gouge.

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By contrast, the same damage to the ceramic coated substrate will not spread corrosion in oil and gas facilities because the carbon steel's surface is turned into an alloy of stable oxides. Once the steel's surface is stable (the way noble metals like gold and silver are stable) it will no longer react with the environment and cannot corrode.

Visible in scanning electron microscope photography, EonCoat does not leave a gap between the steel and the coating because the bond is chemical rather than mechanical. Since there is no gap, even if moisture was to get through to the steel due to a gouge, there is nowhere for the moisture to travel. This effectively stops atmospheric corrosion of coastal tankage and other petrochemical assets.

The corrosion barrier is covered by a ceramic shell that further resists corrosion, fire, water, abrasion, impact, chemicals, and temperatures up to 400 °F. Beyond this, the ceramic shell serves a unique role that helps to end the costly maintenance cycle of replacing typical barrier type coatings every few years.

"In coastal petrochemical assets, such as refineries and storage tank farms, if the ceramic shell and alloy layer are ever breached, the ceramic shell acts as a reservoir of phosphate to continually realloy the steel," explains Merrick Alpert," President of EonCoat. "This 'self heals' the breach, depending on its size, and stops the corrosion if necessary. This capability, along with the coating's other properties, enables effective corrosion protection for the life of the asset with a single application."

The Ningbo Xingang Fuel Storage Company project has been successfully coated with the spray applied inorganic coating, and a topcoat added. EonCoat is compatible with a wide range of commonly used topcoats.

Because of the ceramic coating's multiple layers of corrosion protection, and the ability to "self heal" breaches, the coastal facility is on track to see long term protection of its equipment, effectively breaking the costly cycle of blasting and repainting every few years.

Oil and gas operation managers or corrosion engineers looking to reduce costs are finding additional advantages to CBPC coatings like EonCoat beyond corrosion resistance.

For instance, one of the ways the Chinese government is working to mitigate the negative effects of air pollution is by turning to green alternatives such as CBPC coatings, which are inorganic and non-toxic, so there are no VOCs, no HAPs and no odor. This means the non-flammable coatings can be applied safely even in confined spaces.

Such coatings consist of two non-hazardous components that do not interact until applied by a standard industrial plural spray system like those commonly used to apply polyurethane foam or polyurea coatings.

One of the greatest additional benefits is the quick return to service that minimizes facility downtime. The time saved on an anti-corrosion coating project with the ceramic coating comes both from simplified surface preparation and expedited curing time.

With a typical corrosion coating, near white metal blast cleaning (NACE 2 / SSPC-SP 10) is required to prepare the surface. But with the ceramic coating, only a NACE 3 / SSPC-SP 6 commercial blast cleaning is typically necessary.

For corrosion protection projects using typical polymer paints such as polyurethanes or epoxies, the cure time may be days or weeks before the next coat of traditional 'three part systems' can be applied, depending on the product. The cure time is necessary to allow each coat to achieve its full properties, even though it may feel dry to the touch.

With traditional coatings, extensive surface preparation is required and done a little at a time to avoid surface oxidation, commonly known as 'flash rust', which can require re-blasting.

In contrast, a corrosion resistant coating for carbon steel utilizing the ceramic coating in a single coat requires almost no curing time. Return to service can be achieved in as little as one hour. This kind of speed in getting an asset producing again can potentially save hundreds of thousands of dollars per day in reduced downtime in oil and gas applications.

With atmospheric corrosion a perennial problem for oil and gas facilities with massive carbon steel structures, the utilization of CBPC coatings that can control corrosion for decades will only help the bottom line.

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