

Removal of Rust Staining Caused by Crevice Corrosion

Enviroklean Reduces Manpower, Materials Cost for Maintenance

By Graham George • Sheldon Landsberger

It is well known that exposure to the changing elements in the marine environment causes many ongoing corrosion-related issues to ships and various metallic structures, such as barges, drilling rigs, ballast tanks, bridges, supporting vessels and even concrete structures with rebar reinforcement. Concrete may experience erosion, exposing the supporting rebar structure and causing corrosion and rust staining as iron oxide leaches from the affected steel.

The splash zone, which generally references areas that are continuously exposed to both water and air in a wet/dry environment, promotes the extreme conditions that initiate the corrosion phenomena. In many cases, crevice corrosion is the general cause for the unsightly rust staining of various surfaces, which can eventually lead to pitting, the failure of the protective coating and the more extreme stages of corrosion. As corrosion progresses, wall loss and possibly hydrogen embrittlement may affect the integrity of these structures, causing greater, more expensive repairs or even replacement. General rust staining is caused by fluid passing over the rusted or corroded areas where leeching occurs and transporting the iron oxide in liquid form, causing in many cases unsightly and unwanted staining.

Navy, Coast Guard and Merchant Marine vessels are particularly susceptible to this corrosive environment. Historically, the general solutions are limited and include

either: painting over the issue to hide the unsightly staining of the specific area, or the refurbishment of the problem area, which includes removal of the existing coating, preparation, material selection and then recoating.

A total refurbishment of the stained area is in most cases very expensive and often time consuming. Painting over the rust staining is unnecessary and often causes additional problems such as increased weight due to the added coating, thereby increasing flammability concerns.

Concealing the problematic area is often false economy as the integrity of the actual stained coating is intact. Simply covering the issue utilizes many man-hours and expensive material costs that hide rather than solve the problem. These combined issues have plagued the integrity of various structures and surfaces for centuries.

Specifically, Navy and Coast Guard vessels that encounter longer patrolling times in the open seas and oceans and aging steel structures require constant maintenance utilizing human resources



(Top right) Scale embedded on steel flange with its before and after weight related to rust treatment. (Photo Credit: Nuclear Engineering Training Laboratory, University of Texas) (At right) USS Zumwalt during cleaning. Note the left side of the ship after cleaning with EPDI's Enviroklean.





Before rust removal on the USS Nitze.

and expensive maintenance material costs. Historically, there have been several efforts to predict corrosion rates, as well as other cathodic protection methods, including but not limited to the use of a combination of aluminum alloy and aluminum-infused coatings acting in a sacrificial manner to protect the steel or structure.

Safe Chemical Solutions

Enviroklean Product Development Inc. (EPDI), founded in 2009, manufactures and is licensed to provide specialty chemicals, NORM (naturally occurring radioactive materials) solutions, waste remediation services, cathodic protection and corrosion solutions to the energy industry, Department of Defense and various other clients.

While there are many commercial products available that attempt to mitigate or eliminate corrosion, EPDI manufactures a range of proprietary chemicals that are superior and are uniquely formulated and designed to successfully and safely remove various levels of corrosion including rust, rust staining, mildew, carbon, grease and oil from steel, fiberglass, concrete and various coated and uncoated surfaces and equipment.

In addition to rust and rust stain removal, experiments were conducted in 2015 at the University of Texas for the removal of radioactive scale from a steel flange using EK2012 (EK S&C). After 20 hours, the EPDI product EK2012 successfully removed 20.7 grams of the rust scale and 96 percent of the radioactivity. It has been scientifically confirmed that rust scale and calcium both act as hosts to specific radioactive isotopes such as Radium-226, Radium-228 and Lead-210, which may add additional unwanted problems when present.

EPDI has successfully conducted rust removal in

numerous, various situations and locations, such as on board the U.S. Navy ships USS *Arleigh Burke*, USS *Nitze*, USS *Iwo Jima* and USS *Midway*; Sherman tanks located at the museum in Scofield barracks in Hawaii; and the Aloha Liberty Bell.

In 2016, the Department of Defense requested that EPDI supply the product Enviroklean to clean construction debris staining from the entire structure of the USS *Zumwalt* while it was located in Norfolk, Virginia, before this remarkable, technically advanced ship was commissioned. The total product cost for cleaning the entire ship was less than \$5,000 and was performed in less than one week. The alternative solution was to replace the entire ship's coating, which would have taken months and at a cost of several million dollars.

Enviroklean was simply sprayed onto the surface of the rust-stained area and gently agitated with a brush for 3 to 5 minutes and then rinsed clean with water, leaving a clean coating with no unwanted or unsightly residues.

EPDI has successfully developed a range of unique chemical products that have been proven to work in the laboratory environment, as well as on USS Navy ships, vessels and other marine equipment for quick rust removal in a highly efficient and safe manner.

Enviroklean's chelating action is designed to remove the rust staining caused by crevice corrosion, making it easier to locate the source of the staining or leeching, which in most cases is crevice corrosion. Enviroklean is environmentally friendly, nontoxic, nonflammable, contains no VOCs, is a nonbioaccumulating formula that does not leave any appreciable residues, and can be used on various surfaces and coatings. By removing the surface staining, it is easier to locate the source of the rust staining to initiate a corrosion repair, reducing maintenance costs and preventing further staining and corrosion issues. Enviroklean is a more cost-effective solution than traditional maintenance methods. By utilizing EPDI products and methods, human resources as well as material costs are substantially reduced. **ST**

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