RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

Advances in Protecting Submerged Infrastructure from Invasive Mussels

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For the past nine years, the Materials and Corrosion Laboratory (MCL) at the Technical Service Center has been researching coatings and materials for invasive species zebra/quagga mussel control.

Mission Issue

The coatings team has evaluated over 100 coatings and materials to mitigate and prevent mussel attachment.

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Problem

In 2007, invasive quagga mussels were discovered in Lake Mead and subsequently downstream from Hoover Dam. Invasive mussels are a nuisance mollusk that attach to submerged surfaces. They also attach to hydraulic structures and can impair their function. The Materials and Corrosion Laboratory (MCL) at the Technical Service Center has been researching coatings and materials for zebra/quagga mussel control for the past nine years. Since 2008, the coatings team has evaluated over 100 coatings and materials to mitigate and prevent mussel attachment.

In 2008, the coatings team conducted a field inspection of Parker Dam, located at Lake Havasu Reservoir on the border between Arizona and California. Researchers observed that silicone foul release coatings (FRCs) prevented mussels from attaching to the structures. In comparison, the steel control grating structures were completely fouled, thereby greatly reducing flow through the grate. This was unexpected because these coatings were designed to allow fouling on ships while docked, but the fouling organisms would wash off the coating surface as soon as ships departed.

Other observations during this inspection revealed that although all previous research by others evaluated coatings in static exposure only, mussel populations accumulated to a greater degree in flowing water conditions than in static water. Furthermore, antifouling paints did not work under flowing water conditions. Most of the copper alloys, including Z-Alloy, prevented mussel attachment; the 90-10 copper-nickel was the exception.

Solution

In 2013, two new products were evaluated that provided durability and mussel control. A Material Transfer Agreement (MTA) partner's experimental polyurethane/ polysiloxane FRC were observed to prevent mussel fouling.

Left to right: Silicone foul release coating, steel, Z-alloy after 24 months of exposure.

"The results of this research helped Reclamation conclude that antifouling coatings were not effective in flowing water but were

effective in quasi-static water. This also showed that results from previous research done by other agencies had misleading results because they only evaluated coatings in static conditions."

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Collaborators

Reclamation Lower Colorado Region

Lower Colorado Region Dams Office

Staff at Parker Dam

More Information

https://www.usbr.gov/research/projects/detail.cfm?id=7089

https://www.usbr.gov/research/projects/researcher.cfm?id=859

Application and Results

As of 2017, after four years of testing, these new product coatings are still providing easy clean surfaces. Jotun Sealion Resilient, an epoxy silicone FRC, is a hard coating that allows fouling to occur, but is still easily cleaned after four years of testing.

Both durable systems were identified before the US Navy knew of the technologies.

MTA partner durable FRC (left), Jotun Sealion Resilient easy-clean system (right).

Future Plans

Results of tests conducted at the test site at Parker Dam are informative and key to determining actual field performance of these coating systems. Evaluating coatings at this site should continue. Possible performance improvement of any experimental or new commercial product is only theoretical until proven by field testing for the efficacy of mussel control. Reclamation should continue to support the development of new materials with MTA partners, and field test the new formulations to help improve technologies. The partners have demonstrated durable formulations that perform well in field testing.