RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

UV Control of Biofouling in Generator Cooling Systems

UV reduces maintenance costs associated with biofouling in generator cooling systems

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HOD UV treatment of generator cooling system water was found to reduce invasive mussel, hydroid, sponge, and bacterial fouling, resulting in reduced maintenance at Parker Dam.

Mission Issue

HOD UV treatment of biofouling was found to reduce maintenance costs by $80,000 per year.

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Problem

Reservoirs along the lower Colorado River are infested with *Dreissena rostriformis bugensis* (quagga mussel) and *Cordylophora caspia* (colonial hydroid). These invasive species, along with native freshwater sponges and bacteria, pose significant biofouling issues for hydropower facilities in the area.

Biofouling in generator cooling systems can lead to overheating and unplanned outages. Biofouling at Parker Dam, on Lake Havasu, AZ has resulted in increased annual maintenance costs of approximately $80,000/year.

Hydroid biofouling is also becoming a significant issue at the Central Arizona Project, Mark Wilmer Pumping Plant, located on Lake Havasu, just east of Parker Dam. Severe hydroid biofouling of the surface-air coolers overheated pump units, resulting in one unplanned outage in 2014 and three unplanned outages in 2015.

Solution

The following study was conducted over a two-year period and was designed to evaluate the effectiveness of the HOD UV systems at Parker Dam for settlement reduction of multiple biofouling species.

The impact of HOD UV on biofouling was monitored by measuring the combined dry weight of dreissenid mussel, freshwater sponge, colonial hydroid, and bacterial settlement on plates in bioboxes downstream of the HOD UV units and comparing the results with data collected from an identical biobox upstream of the HOD UV.

The overall performance of the HOD UV units and the impact on the maintenance of the generator cooling systems was also observed.

"Since the implementation of HOD UV at Parker Dam operators have noticed a substantial reduction in cooler overheating and maintenance requirements."

John Steffen
Parker Dam Manager
Reclamation

Collaborators

RNT Consulting Inc.
Lower Colorado Dams Office
Parker Dam
KASF Consulting, LLC

More Information

https://www.usbr.gov/research/projects/detail.cfm?id=1712

https://www.usbr.gov/research/projects/researcher.cfm?id=2511

Application and Results

Comparison of biofouling dry weight from settlement plates exposed to HOD UV-treated and untreated water indicate a significant reduction in total biofouling after HOD UV exposure. Mussel settlement and bacterial sludge formation were consistently reduced in test chambers (bioboxes) despite lower than expected average HOD UV dose and contamination with untreated water. Hydroid larvae were not found in any plankton samples collected from the forebay at Parker Dam during the study, indicating asexual reproduction was the main source of downstream colony formation. Hydroid settlement reduction data after HOD UV treatment were inconclusive.

The Parker Dam facility manager confirmed that biofouling-related maintenance of the coolers was reduced by 75 percent after the first year of HOD UV operation and eliminated in the second and third years after implementation, resulting in an estimated savings of $80,000 per year.

Future Plans

The successful use of HOD UV treatment at Parker Dam for a variety of severe biofouling issues can serve as a case study for other facilities impacted by biofouling. Annual turbidity profile expressed as percent HOD UV transmissibility (UVT) should be obtained at any location considering an HOD UV system so that the unit installed can deliver the required dose even under the least favorable conditions. Installation of HOD UV treatment is planned at several Reclamation and US Army Corps of Engineers facilities where biofouling of invasive mussels is problematic.

HOD UV unit installed at Parker Dam for reduction of biofouling the generator cooling systems.