

SiCURE BWMS

Addressing Safety Issues

By Vadim Zolotarsky

The SiCURE Ballast Water Management System (BWMS) developed by Siemens Water Technologies uses electrolysis to produce sodium hypochlorite from the seawater it is treating. The system uses the same principles and core components as the Chloropac system that prevents bio-fouling in cooling water circuits on thousands of oil platforms and ships around the world. Any ballast water management system must comply with International treatment standards and be safe to the ship, crew, passengers, and the environment.

One of the main factors that determines the lifetime of marine vessels is corrosion, the effect of which is a reasonable concern as the sodium hypochlorite produced during ballast water treatment is often perceived as being possibly corrosive to the ship's ballast tank structural materials and coatings. Therefore, while the selected hypochlorite dosing levels should meet IMO D2 regulation standards, they should also minimize the hypochlorite residual in ballast tanks to prevent possible corrosion issues. Both of these concerns are assuaged by the SiCURE BWMS' design and control logic.

The Siemens system's design requires that all ballast water treated pass through an automatic back-flush filter with a 40µm screen specifically designed for ballast water treatment. This step removes a large share of marine organisms and sediments, thus minimizing the demand for disinfectant required for treatment. Filtered water is then treated with sodium hypochlorite generated on-board electrolytically using a small side-stream (about one percent of the ballast water

flow) and a stand-alone electrochlorination system.

Furthermore, the patent-pending oxidation-reduction potential (a.k.a. redox or ORP)-based control logic of the SiCURE BWMS assures that only the amount of hypochlorite necessary for effective treatment is produced and injected into the ballast water main. The variable, dose-on-demand treatment is capped at 6 mg/L (ppm).

CORROSION STUDY: CONSTRUCTION MATERIALS AND TANK COATINGS

In 2010, Siemens conducted a six-month long corrosion test program to evaluate the impact of hypochlorite in

general and of treatment with a SiCURE BWMS in particular on shipbuilding materials and coating. This program was carried out at Pasir Ris in Singapore using flow-through setup and test conditions specified in the GESAMP/MEPC guidelines. The study was supervised by Germanischer Lloyd from its inception to completion. The impact of untreated seawater and seawater treated with hypochlorite to 6 mg/L residual level were benchmarked for various alloys (uncoated shipbuilding steel, stainless steel, copper and nickel alloys), gasket and valve seal materials (EPDM, PTFE), and International Paint's Intershield 300 epoxy-based tank coatings. The study



The SiCURE Ballast Water Management System can be supplied pre-assembled for new constructions or as separate components for retrofitting.

looked at general pitting and crevice corrosion for uncoated alloys, stability of gasket materials and blistering and adhesion of the coated samples. A short-term electrochemical study was also carried out to measure free corrosion potential of various alloys at different redox potentials of treated water. It also included potentiodynamic polarization of various samples to determine their stability against localized corrosion.

Results showed that the use of hypochlorite for treating ballast water may indeed result in increased corrosion rates for uncoated carbon steel (0.11 mm/year) compared to untreated seawater (0.07 mm/year). It was also shown that the effect of treated ballast water on other metals like stainless steel, brass and cupro-nickel is very low (< 0.01 mm/year) while gasket and seal materials were not affected by the treatment. Interestingly, results showed that crevice corrosion of stainless steel in seawater can be even reduced in the presence of hypochlorite. Results of testing the Intershield 300 coating in treated seawater showed no effect on ballast water coatings at hypochlorite concentrations used by the SiCURE system. Importantly, the study showed that concentration of hypochlorite at about or below 1 mg/L had little or sometimes even a positive effect on anti-corrosion stability of carbon and stainless steel. Stability was reduced at greater hypochlorite concentrations.

As the SiCURE system's design and dose-on-demand control logic ensures that the minimum required amount of active substance is being used during treatment, typically the concentration of hypochlorite in the ballast tanks drops to about or below 1 mg/L within the first 24 hours after treatment. Therefore, the corrosion study confirmed that a treatment of ballast water with SiCURE BWMS should not have any corrosion impact on ships' ballast water system construction materials.

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