

Frequently Asked Questions – SiCURE™ Ballast Water Management System By Siemens Industry, Inc.

Q: *Does the SiCURE™ system use active substance?*

A: Yes, the SiCURE™ system uses a combination of physical separation and on-demand treatment with biocides, produced in-situ from seawater, without the addition of chemicals. The system uses the well-known Chloropac® CTE (Concentric Tube Electrode) technology to produce the biocide.

Q: *What is the dose of active substance used in the SiCURE™ system?*

A: The SiCURE™ system uses an on-demand dose of sodium hypochlorite of up to 6 mg/L Total Residual Oxidant (TRO).

Q: *When is the SiCURE™ system used?*

A: Ballast water treatment is carried out on uptake only. The SiCURE™ system's dose-on-demand control logic minimizes the amount of active substance required to ensure meeting IMO standards. As a result, the active substance naturally decays in the ballast tanks during the vessel's voyage.

Q: *Will treatment with the SiCURE™ system lead to accelerated corrosion in the ballast tanks and piping?*

A: Considering the importance of this issue, Siemens carried out an extensive corrosion test program in cooperation with Thyssen Krupp and International Paint, under supervision from Germanischer Lloyd. Various alloys, ballast tank coatings and gasket materials were tested in 6-month long, around-the-clock tests using natural seawater and 6 mg/L TRO concentration – the maximum dose level used by the SiCURE™ system.

Corrosion rate: Germanischer Lloyd concluded that dosing sodium hypochlorite at a 6 mg/l level has no significant effect on the corrosion rate of carbon steel. Corrosion rates of stainless steel 316L, Brass CDA687 and Copper-Nickel CDA715 experienced a marginal corrosion rate increase.

Pitting corrosion: No significant differences between samples immersed in chlorinated (at max SiCURE dosage level of 6 mg/L) and unchlorinated seawater could be detected.

Ballast Water Tank Coating: Tests with coating system Intershield 300 (International Paint) show that an addition of 6 mg/l NaOCL does not have any significant influence on coating performance. When using other coating systems the manufacturer should be consulted for information of resistance of the coating system to chlorine concentrations of up to 6 mg/L.

Q: *What is the SiCURE™ system's Type Approval and IMO certification status?*

A: As with any system that uses active substance, the SiCURE™ system requires Basic and Final Approvals from IMO and Type Approval from any IMO Member's Flag Administration. The SiCURE™ system received Basic Approval from IMO in March 2010. The system has also passed the required IMO land-based tests in fresh water at the Port of Superior/Duluth on Lake Superior, and in brackish water at Port of Baltimore in Chesapeake Bay, Maryland. The German flag state administration Bundesamt für Seeschifffahrt und Hydrographie (BSH) did apply for Final approval for the SiCURE BWMS in December 2010. The IMO expert group GESAMP-BWWG reviewed the dossier in September 2011 and recommended the SiCURE system for Final Approval. Final Approval is forecasted to be received by MEPC in spring

2012. Upon completion of shipboard tests, Siemens expects that the SiCURE™ system will receive Type Approval from the German Flag Administration BSH in the second half of 2012.

Q: *What are the major benefits of using the SiCURE™ system?*

A: The SiCURE™ system was designed with practicality and safety in mind. Low power consumption of the system and treatment only on uptake of ballast water eliminates any need for an additional power source. Also, the system's unique "flexible footprint" feature allows for installation where there is space available in the engine or pump room. Low maintenance requirements make the system easy to use and operate.

Q: *How reliable is the SiCURE™ system?*

A: The SiCURE™ system has naturally evolved from Siemens' well-known Chloropac® CTE technology for the prevention of biofouling in shipboard seawater cooling systems. With over 2,500 shipboard Chloropac® installations over the last 30 years, this proven technology enables the SiCURE™ system to become a safe and reliable solution for meeting ballast water management regulations.

Q: *Will ballast water treatment extend the time in port?*

A: The SiCURE™ system provides ballast water disinfection via filtration and electrochlorination only on ballast water uptake. Possible delay due to the SiCURE™ system would be related to how often its filter backwashes and to how the existing ballast water pumps cope with a modest increase in back pressure between the backwash filter cycles. With a pressure drop of just 0.5 bar through the SiCURE system filter, the delays even in waters with high sediments should not exceed 10 – 15%. The highly efficient and reliable filter used by the SiCURE™ system requires only 2 – 6% of water flow for automatic back flushing.

Q: *Can the SiCURE™ system operate in ports with fresh or brackish water?*

A: Yes, but only on those vessels that enter fresh water ports from the sea. Electrochemical reactors of the SiCURE™ system are installed independent of the ballast water main and are fed by a small side stream from the main when the ship is in saltwater, or with seawater stored aboard the ship when in the river or brackish water. Only a fraction of the ballast water flow is required to operate the SiCURE™ system – about 1 percent of the ballast water flow.

For example, an LNG carrier with 100,000 tons ballast water capacity and two 3000 m³/h ballast water pumps would need to store about 750 m³ to feed the SiCURE™ system for its ballast water pumps; a vessel with 40,000 m³ ballast water capacity would need to store 125 m³ to feed the SiCURE™ system for its 900 m³/h ballast water pump. After-peak tanks can be used to store this sea water feed.

Q: *Will the SiCURE™ system be able to meet more stringent California (1000 x IMO) treatment standards?*

A: Individual states in the USA do not plan to certify ballast water treatment systems (Reference: OCTOBER 2010 UPDATE: BALLAST WATER TREATMENT TECHNOLOGIES FOR USE IN CALIFORNIA WATERS). They will rely on independent third party evaluations.

To our knowledge, the reports published to date by independently operated test facilities such as NIOZ, MERC and GSI show the ability of commercially available systems to comply with IMO regulations. The published data show that no tested system would meet 1000 times stricter standards without amendments. In 2009, the US Coast Guard proposed standards that correspond to the IMO regulations in phase 1. In 2013, they will evaluate whether or not there are sufficient suppliers that comply with stricter standards. To date, the test facilities are not

able to verify whether or not a system is able to meet standards 1000 times stricter than the proposed IMO treatment standards.

Siemens has designed the SiCURE™ system to meet IMO standards. Since the SiCURE™ system is modular, Siemens will evaluate amendments to comply with more stringent treatment standards when such a need evolves.

Q: *Are there any operational restrictions regarding the nominal capacity of the SiCURE™ system (i.e., is it possible to operate the system throughout the entire range of the pump's capacity [0 -X m³/hr])?*

A: Yes, the SiCURE™ system's dose-on-demand control logic will adjust the dosing rate of the biocide to meet changes in the ballast water flow rate or water quality.

Q: *What is the electric power consumption of the SiCURE™ system?*

A: The SiCURE™ system's power requirements are quite low – below 75 kWh per 1000 m³/h flow of ballast water. It is important to note that as the SiCURE™ system is used only on uptake, this power consumption covers an entire Fill/Discharge cycle.

Q: *What is the operational cost of the SiCURE™ system?*

A: Based on a price of \$650 USD per ton of Heavy Fuel Oil (IFO 180), the cost of treatment with the SiCURE™ system is estimated to be between \$11 USD and \$14 USD per 1000 m³/h flow of ballast water.

Q: *What are the maintenance requirements of the SiCURE™ system?*

A: Maintenance requirements for the SiCURE™ system are minimal and are limited to the calibration of sensors and the preparation of dechlorination solution if required.

Q: *Is the installation of a dechlorination step required when using the SiCURE™ system?*

A: The dose-on-demand control logic of the SiCURE™ system matches dosing levels with the chlorine demand of the ambient water, ensuring the minimum required amount of active substance is added to the ballast water. This prevents overchlorination, or an excessive amount of active substance in the treated water. With this logic, the residual concentration of active substance in treated ballast water is low and naturally decays over the minimal holding time of 5 days. This ensures that the discharge limit of 0.1 mg/L TRO is always met. In the event that vessels operate on trading routes with the need to discharge treated ballast water prior to a 5 day holding time, the system can be equipped with an optional dechlorination unit.