



Frequently Asked Questions

Ballast Water Management System

ECOCHLOR TREATMENT TECHNOLOGY

What is chlorine dioxide (ClO₂)? ClO₂ is a powerful biocide that reacts with living cells by first penetrating the cell wall and then reacting with the material within the living cell in order to kill the organism. ClO₂ has been used in a wide variety of land-based treatment applications, including drinking water, municipal waste processing, food, pulp, and paper production for over 70 years.

ClO₂ offers a number of advantages over other ballast water disinfection methods and techniques; it is effective on all aquatic organisms, including bacteria and other pathogens, and is effective anywhere in the world with no limitations when it comes to temperature, salinity or turbidity.

How is the Ecochlor ClO₂ treatment technology different from BWMSs that use chlorine to treat ballast water? While both chlorine (bleach) and ClO₂ are oxidizing agents, they disinfect ballast water in two fundamentally different ways. ClO₂ targets living cells and has very limited reactions with non-living organic matter present in ambient water. It works exceptionally well in waters with high levels of organic matter ("dirty" or turbid waters) and produces minimal disinfection by-products.

On the other hand, chlorine reacts with almost any organic material (living and non-living) such as oil, algae, sediments, etc. This means that waters with high levels of organic matter increase the demand for chlorine, leaving less of the chemical available to treat living organisms. This is typically addressed by increasing the dose in "dirty" water. Due to the types of reactions that chlorine has with both organic and inorganic compounds, chlorine has a greater potential to form undesirable disinfection by-products.

The high levels of chlorine required to treat ballast water comes with operating limitations — neutralization is required to ensure chlorine can be discharged safely and high concentrations of chlorine can damage ballast tanks.

How does the Ecochlor® BWMSs work? All three of Ecochlor's BWMS products rely on the same core ClO₂ technology - treating ballast water with a low dose of ClO₂. The active substance is generated by pumping two precursor chemicals into a small mixing chamber, which when combined produce ClO₂. An eductor draws the ClO₂ from the mixing chamber and mixes with the motive water supply to generate a ClO₂ solution. This solution is injected into the ballast water main. When ClO₂ is no longer required, the treatment system is thoroughly flushed with water to remove all residue so that it is ready for the next ballast uptake.

What are the key advantages of the Ecochlor® BWMS, EcoOne® and EcoOne® Hybrid BWMS? Ecochlor's powerful treatment technology meets or exceeds both USCG and IMO regulatory requirements and offers the following benefits:

- The BWMS is engineered for reliability and low maintenance
- Minimal crew involvement during system operation
- Small footprint even for vessels with high flow rates
- Low power requirements, possibly the lowest in the industry
- Option for no-filter operation with the EcoOne® and EcoOne® Hybrid
- Installation flexibility: Treatment System can be placed in any convenient location as modular components. The Ecochlor System allows for the flexibility to design a skid-mounted system
- No ballast water treatment or neutralization required at discharge
- Gravity ballasting on discharge (in filterless mode) gravity ballasting on intake

What are Ecochlor's line of products? Ecochlor's three product lines incorporate ClO₂ technology in different ways to provide shipowners flexibility in the installation and operation of their BWMS.

- EcoOne® BWMS (ClO₂ alone): This system treats ballast water by injecting a dose of 4.6 mg/L of ClO₂. The system includes a generator cabinet, tanks, and injection components. Vessels operating this system can operate anywhere in marine and brackish waters (i.e., ≥ 1PSU) and with no restrictions on temperature or turbidity.
- EcoOne® Hybrid BWMS (Dual mode filtration & ClO₂ or ClO₂ alone): This system will allow shipowners to operate their BWMS either with or without a filter. This system treats ballast water by filtering the water to 40 microns and then injecting a dose of 4.25 mg/L of ClO₂. Vessels operating this system can operate anywhere in the world with no restrictions when it comes to temperature, salinity, or turbidity. This option will be suited for shipowners who wish to have the flexibility of unrestricted operation globally, with the convenience of a no-filter system.

TECHNICAL & REGULATORY CONSIDERATIONS

Why is ClO₂ particularly well-suited as a filterless BWMS option? Because ClO₂ is not affected by suspended sediments or turbidity, filtration is not necessary to remove sediments prior to treatment with ClO₂. This is in contrast to UV or similar technologies that require the removal of sediment for the UV light to disinfect ballast water, and electro-chlorination or similar hypochlorite-based treatment technologies, that require high doses of chlorine to treat "dirty" water. As a result, Ecochlor is uniquely suited to offer a filterless system with very low power consumption and chemical dose that also protects vulnerable tank coatings.

Can the Ecochlor® BWMS treat very high flow rates? Ecochlor® BWMSs have some of the highest operating capacities in the ballast water treatment industry. Our current type approvals allow our system to be operated at flow rates of up to 16,200 m³/hr.

Does the Ecochlor® BWMSs need TRO sensors? No. TRO sensors are typically used in electro-chlorination and similar chlorine-based BWMS technologies to regulate both the chlorine dose on uptake (in response to varying water conditions) and the neutralizing dose required during discharge. The Ecochlor system uses a fixed, low dose of ClO₂ regardless of water conditions. There is no requirement for neutralization on discharge there are no TRO sensors needed.

Are there any hold times for treated ballast water discharge? While the Ecochlor System does not have a hold time related to system efficacy, it does have a required hold time prior to discharging treated ballast water. The hold time commences once the individual ballast tank is completely filled. Ecochlor's treated ballast water minimum hold time is 48 hours plus confirmation that residual ClO_2 concentrations have reached the maximum allowable discharge concentration (MADC), which is confirmed using a simple test. Data collection is pending for 24 hours hold time.

Will the use of ClO_2 have any effect on ballast tank coatings or increase corrosion inside the ballast tanks? There should be no effect on tank coatings or corrosion rates when utilizing the Ecochlor system. This was confirmed through tests on four different epoxy coatings and bare steel panels conducted by independent laboratories with samples analyzed by 3rd party experts, including a marine coatings supplier. At the conclusion of the study, International Paint also provided a letter indicating that the Ecochlor® BWMS is unlikely to have a detrimental effect on epoxy ballast tank coatings approved to IMO Resolution MSC.215 (82). All testing was performed using a ClO_2 concentration of 5.0 mg/L; a concentration 9-18% higher than is currently utilized with the Ecochlor® BWMS product lines.

What are the system's safety measures? Ecochlor takes crew safety seriously and has incorporated multiple features to ensure the system does not pose a risk to its users. Some of these measures include:

- Chemical storage tanks designed and fabricated for installation on the vessel main deck or above. Each tank is mounted inside a secondary containment system made from carbon steel coated with a chemical resistant coating and designed to hold 100% of the tank volume at a 37° vessel list. The secondary containment is equipped with sensors to detect the presence of fluid with an alarm condition to shut down the system and alert the crew in the event of a leak.
- Multiple mechanisms to prevent the accidental release of ClO_2 including fault interlocks to prevent generation of ClO_2 when other system components are not operating and checks to ensure all ClO_2 that is generated is used for treatment.

In the unlikely event of a release, the system comes with ClO_2 detectors to provide a warning and automatically shut down the system to prevent the release of harmful concentrations of ClO_2 .

Are there any compliance requirements associated with the Ecochlor system? The Ecochlor® BWMS has IMO Norway BWMS Code Type Approval (2020), G9 Type Approval (2010) as well as USCG Type Approval (2017). EcoOne® and EcoOne® Hybrid BWMS have IMO Norway BWMS Code Type Approval (September 2021) and USCG Type Approval (December 2021). We also have a number of Flag State and Classification Society Type Approval Certifications. An updated list is on our website at <https://ecochlor.com/imo-uscg-regulatory-approvals/>

VESSEL COMPATIBILITY

Can the Ecochlor system be installed on a Tanker with hazardous zones? Yes. The system is approved for installation in both U.S. Flag and foreign flag vessels in hazardous zones rated Zone 1 or Zone 0. The treatment system equipment must be installed within an enclosed, non-hazardous area, typically a deckhouse or dedicated space.

Does the system require the construction of a deckhouse? Whilst the system can technically be installed in any suitable location on the vessel, it must be installed within a self-contained area that complies with both Flag state and IMO / USCG Type Approvals requirements. A number of factors including the system design and layout of the vessel will need to be considered by an engineering firm to determine the best approach for system installation, but most customers proceed with the construction of a deckhouse to address the installation requirements.

What are the advantages to installing an Ecochlor system on a bulk carrier with gravity-discharge top side tanks? Typically, these types of bulk carriers discharge their ballast tanks directly overboard without using pumps or transferring the ballast water back through the pump or engine room. In order to install a UV or electro chlorination system on this type of vessel, piping modifications are required to re-arrange piping to allow for ballast water to be retreated or neutralized. These modifications are both costly and, more importantly, could lead to operational difficulties of the vessel.

Because the Ecochlor System does not require re-treatment or neutralization on discharge, the system can be installed on a bulk carrier with gravity discharge top side tanks. A main ballast flow control valve(s) would be required during the installation. The transition from gravity to pump ballast treatment is as simple as pressing the 'disable gravity ballast' button in the Human Machine Interface (HMI) software to close the main ballast control valve, which then allows the main ballast pump to restart the BWMS in normal operation.

With the new filterless EcoOne® BWMS and the EcoOne® Hybrid BWMS (in filterless mode) gravity ballasting is an option on both intake and discharge. Additionally, by eliminating the filter, these BWMSs have even lower power requirements.

EQUIPMENT

Can I convert my standard Ecochlor® BWMS to an EcoOne® BWMS? Yes. The EcoOne® BWMS is the same design as a standard Ecochlor® BWMS with a few minor modifications. These include

Removal of:

- Filter(s) (or filter screens)

Addition of:

- Duplex strainer, with one millimeter screen, which is designed to ensure that large particles don't reach the treatment unit
- Conductivity sensor to certify that the unit is being operated in the correct mode for either freshwater or marine/brackish water
- Pressure transmitter to further enhance reliability of operation
- Updated software

What are the benefits of the EcoOne® BWMS?

The benefits of converting to an EcoOne® BWMS are easier operation and maintenance for crew along with very low power requirements, while still utilizing the same high quality, reliable construction and high level of service included in all the Ecochlor® BWMSs.

OPERATIONS

How difficult is it to operate the Ecochlor® BWMS? The Ecochlor system is amongst the simplest and easiest to operate in the industry. Continued input from your personal vessel delegate and multi-level training tools ensure that every crew member can quickly and safely be brought up to speed with all the operational knowledge of the system.

Are there different operational limitations between the Ecochlor® BWMS and the EcoOne® and EcoOne® Hybrid systems? Yes, the Ecochlor® BWMS and the EcoOne® Hybrid (in filter mode of operation) have no operational limitations with respect to temperature, turbidity and salinity. While the no-filter EcoOne® system is not limited with respect to temperature or turbidity, it can only be operated in marine or brackish water (i.e., greater than 1 PSU).

What if a vessel has to ballast in water below 1 PSU? If a vessel fitted with an EcoOne® system is found to be in freshwater under extraordinary circumstances (for example, an area where water is usually brackish but may temporarily be fresh due to extraneous circumstances) then special procedures are available to enable operation of the system. If the average PSU over the ballast period is lower than 1 PSU then the incident must be logged.

If a vessel has to regularly ballast in waters below 1 PSU, then we offer the EcoOne® Hybrid BWMS. The treatment cabinet is the same as the EcoOne®, but we've brought back in the filter allowing for the ability to use the system in freshwater.

Some owners have already expressed a desire to have a different capacity flow rate on freshwater compared to marine and brackish. This would allow them to fit a smaller capacity filter for freshwater operation only and, thereby, still enjoy the benefits of a smaller footprint in the filter location.

MAINTENANCE

What is the design life of the Ecochlor® BWMSs? Our system is designed for the life of the vessel. It meets, and often exceeds, class society and industry standards and is 'fit for purpose' all the way down to the component level. We use high-quality components and a simplified system operation to minimize equipment failure and maximize the life of our system.

The Ecochlor "Three Pillars of Reliability":

- Powerful treatment technology along with a simple to use system
- High-quality construction engineered 'fit for purpose'
- Best-in-class service support

Do you have a way of confirming the reliability of your BWMS? Yes. Ecochlor receives crew feedback on every ballast operation, demonstrating that over 98% of Ecochlor® BWMSs are operational. Ecochlor's BWMSs are inherently simple in their design and as we all know in the marine environment, simple means reliable - less equipment means easier operation for the crew and, of course, lower maintenance needs. Plus, we've made our already commendably reliable system even simpler and more reliable with the EcoOne® BWMS.

What are the maintenance requirements? The Ecochlor® BWMS requires very little periodic maintenance. During commissioning a preventative maintenance schedule is provided to the crew in the Operation Maintenance Safety Manual (OMSM).

Maintenance activities are scheduled in a frequency ranging from 12 to 60 months and involve routine inspection activities. It is recommended that the ships have some key spare parts on board. Chemical resupply will be performed approximately two (2) times annually (dependent upon the number of ballasting operations), which allows for the Ecochlor technicians to attend the vessel regularly and identify maintenance requirements early.

INSTALLATION

What additional services does Ecochlor offer shipowners to assist with BWMS installations? Through a network of partners, Ecochlor offers a full range of options to provide shipowners additional support for system installations. These services include:

- Integration engineering
- Door to door shipping including assistance with ocean or air shipping, customs clearance and storage
- Installation supervision and commissioning testing attendance (with Class approval)
- Purchase and shipment of high-grade steel and plastic pipe
- Materials to support the installation
- Spare parts for redundancy on board the vessel

Does the vessel have to be in dry dock in order to convert an existing Ecochlor® BWMS to an EcoOne® or EcoOne® Hybrid BWMS?

Ballast piping alterations require the piping to be dry, plus there are modifications to reroute the ballast piping to support EcoOne® Hybrid BWMS installations. We suggest that it be completed during drydocking, but modifications can also be accomplished at berth/quayside. Contact your representative to discuss specific details in deciding the best course for your vessel.

Is the EcoOne® system less expensive to install? Installation costs vary extensively depending on vessel specifications, integration engineering costs, shipyard fees and installation location.

Argo Navis engineers were involved with two engineering studies for the filterless, EcoOne® BWMS. Through this study they concluded that an EcoOne® retrofit could be "completed roughly 25% faster when compared to a standard BWMS with filter." It could also eliminate as much as a week in the time needed for the installation of a BWMS during drydocking.

Additionally, they said to "expect smaller bill of materials and final costs with 40% savings in piping and between 30 to 50% for cabling, not including the savings for any owner's supplied equipment."

Do you have a list of Naval Architect / Marine Engineering firms with experience in the installation of an Ecochlor system? Yes. We maintain a list of integration engineering firms that have completed our installation certification training and have experience with Ecochlor® BWMS retrofits. Please contact your local representative for the most up-to-date list of companies.

Do you have the ability to install systems in Europe, China as well as the USA? The Ecochlor® BWMS can be installed worldwide.

TRAINING

What type of training programs do you have for our crew? During the installation of an Ecochlor® BWMS our commissioning engineers provide both classroom as well as hands-on operational training. After the shipboard hands-on training at commissioning, we offer further optional training at the ship's first full ballast operation, allowing for a more realistic, stress-free learning experience with the engineers on board the vessel.

We also provide an interactive computer-based software training program produced by MARPOL Training Institute, Inc. for vessels with the Ecochlor® BWMS on board. This training program can be installed on the ship's computer network or given to an owner's facility for access on their server during corporate training sessions. We have organized trainings for crew and technical office personnel at shipowner's facility using a portable Human Machine Interface (HMI) training kit, replicating operating and alarm conditions for a real-world experience.

Because we are on board the vessel approximately twice a year for our chemical resupply operation, we can give regular periodic BWMS instruction to new seafarers and to existing crew members' so that their knowledge of the system is refreshed. We believe that the more comprehensive and regular the training offered, the better the operational outcomes.

SERVICE SUPPORT

Where are your service locations? Our service and spare parts networks are located in multiple areas throughout the three main time zones to offer real-time response to our clients. We continue to strengthen our in-house team supported by carefully selected Ecochlor Authorized Installation and Service providers.

Can your technicians remotely access my system to solve problems or troubleshoot with our crew? Yes, with the addition of an Ecochlor Remote Communication Kit, remote connection is possible using the local cellular network. This is independent of the vessel's communication system and is only possible when the vessel is within the range of a local cellular network. Standard supply on new projects after August 2021.

CHEMICAL RESUPPLY

Will the vessel's crew be responsible for chemical resupply? No. Chemical resupply is handled exclusively by our Chemical Operations Team with a process that is quick and easy. Using the Functional Monitoring Data Sheet (FMDS) provided by the crew after each ballasting operation, Ecochlor tracks chemical use, and arranges chemical resupply to the vessel at the appropriate time and location. Working with the vessel's nominated agent, the Chemical Operations Team will coordinate the delivery of chemicals to the vessel at berth or anchor. During chemical resupply there is no direct human contact because the entire process is closed, using special equipment and only Ecochlor trained personnel. Chemical resupply will be performed approximately two times annually (dependent upon the number of ballasting operations) which allows for the Ecochlor technicians to offer new crew training and service maintenance on the Ecochlor® BWMS.

Where do you offer chemical resupply locations? Ecochlor has a significant number of chemical storage hubs and resupply locations strategically positioned around the globe. We have further expansion plans to develop resupply ports on all major shipping routes. Our chemical resupply networks are located in multiple areas throughout the three main time zones to offer real-time response to our clients.



Contact Us

Ecochlor, Inc.®
 285 State Street, Suite 8
 North Haven, CT 06473 USA
sales@ecochlor.com
www.ecochlor.com

