

Ballast Water Treatment



The Evoqua SeaCURE Compact System

Evoqua's USCG approval expected this year

Evoqua's entrance into the BWT system market started in 2012, and, although fairly late into this market, has made some significant strides since then. IMO approval was awarded in 2014 and it is likely that after the summer of this year, USCG approval will be achieved. Evoqua has opened Evoqua Electro Services, which allows for a 'single point of contact' for clients and potential clients. According to Matt Granitto, Business Manager, Ballast Water, Evoqua (USA), "We are the only OEM to offer this facility". For its service capabilities are enhanced by having service centres in the US, UK and in Singapore.

SeaCURE BWT utilises a patented process that injects biocide into ballast seawater before it reaches the large surface filter intakes to reduce the growth marine organisms that become harmful to filters. Available as a compact skid or as modular components, the system is suitable as a newbuild or retrofit installation since biocide generation takes place in small side streams from the main ballast water thus reducing system footprint and optimising available space. The Evoqua SeaCURE system can also be configured to provide marine growth protection for critical on-board seawater cooling systems.

Meanwhile, Evoqua has secured an order from a South Korean shipyard for the supply and installation of SeaCURE BWT systems to two 115,000 dwt crude oil tankers under construction for a Singapore-based ship owner.

Each vessel will feature a 3,000 m³/h capacity SeaCURE BWT, which Evoqua will deliver for installation this summer during the vessels' early construction phase. The vessels are scheduled for delivery in 2018.

Granitto said, "We now have tanker references on newbuilds and existing tonnage. With so many different BWT systems available, ship owners do need to be confident that the system selected is not only compliant, but capable of meeting ship-specific operational and budgetary requirements. The electro-chlorination process at the heart of Evoqua's SeaCURE system is proven technology, capable of handling the high flow rates and variable water quality we encounter during operations."

According to Lars Nupnau, Evoqua's Global Business Development Director, Ballast Water, an influencing factor was the SeaCURE systems ability to treat the vessels' aft peak tank without the need for an additional electro-chlorination unit. "Rather than taking a full flow or in-line approach to ballast water treatment, the small-feed stream process is particularly advantageous to the tanker segment as just one system can treat all ballast water tanks. Typically, a full flow or in-line system would require a second, separate ballast water treatment to manage the aft peak tank, but because the electro-chlorination part of our system is installed in the engine room – a designated safe area – we can use the same electro-chlorination unit.

For the ship owner, this means lower capital expenditure and a less complex, time-consuming installation."

Meanwhile, Evoqua Water Technologies is upgrading its SeaCURE system production facility in Caldicot, Wales, to meet market demand for ballast water treatment systems, as shipowners look to comply with the entry into force of the Ballast Water Management Convention this coming September.

The upgrade will enable Evoqua to expand production of fully assembled SeaCURE BWTS skids. In addition to the expanded capabilities in Caldicot, additional production capacity will be provided by partners who will be licensed to build the SeaCURE system.

"Over the next five years, BWT suppliers could struggle to meet demand if they fail to invest in their production and supply lines," said Chris Thomas, Director of Operations, Evoqua (UK). "The investments will mean that shipowners and shipyards will not have to worry about long lead times, which could delay installation and commissioning schedules, resulting in vessel off-hire."

The investment in Evoqua's production plant includes a new compressed air system, dedicated welding bays and upgraded testing facilities, while component and assembly lines and warehouse capacity have been optimised utilising LEAN processes to streamline production and delivery.

Granitto said, "Roughly 4,000 vessels have been fitted with a treatment system to date, leaving about 30,000 vessels needing to retrofit an effective solution within the next five years. With concerns having already been raised about a potential supply and installation bottleneck, shipowners and yards do need to plan ahead and make sure that suppliers can deliver on time. The investments we have made will allow us meet the market requirement."

The US-headquartered water treatment specialist is also nearing the market introduction of its next generation electro-chlorination cell technology – the core component of its dual-function SeaCURE BWT system.

"We have over 50 years' of knowledge and expertise in electro-chlorination-based water treatment and have been able to perfect the technology, so while other suppliers are still proving their systems we are now optimising the system and looking at standardising production," added Granitto.

To ready itself for that first wave of BWT orders, Evoqua has honed its technology to reduce the system footprint to meet customer requirements.

"We've drastically improved the size of the system which is now one of the smallest electro-chlorination-based ballast water units on the market. We have adapted it as a modular system, reducing components and installation time and complexity," said Granitto, adding



Matt Granitto

that operation and service simplicity has been the key driver behind the optimisation.

IMO approval for Damen

Damen's mobile BWT system has received IMO type approval. An external BWT unit designed primarily for use in ports and harbours, the Damen InvaSave system treats ballast water to the IMO D-2 standard, for ballast water received from inbound ships. It can also deliver water treated to the same standard to outbound vessels. Its mobile, containerised format means that it can be operated from the dockside or from on-board a vessel alongside, receiving or delivering water to a ship.

The InvaSave has been developed with the knowledge that, after September this year, unmanaged ballast water cannot be discharged. Any vessel that cannot take in or discharge its ballast water after that date will be restricted in its operations and there may be financial implications due to demurrage costs. The Damen InvaSave is, therefore, a valuable



Damen's InvaSave BWT system received its world premiere in front of Groningen Seaports at Holland's Delfzijl and Eemshaven.

asset to all ports seeking to minimise vessel delays caused by the need to treat unmanaged ballast water, allowing them to offer a robust, IMO-certified contingency service.

Damen has dedicated years of research on the development of the InvaSave, including collaboration with some of the leading research institutes in the Netherlands - Groningen

Seaports, Wagenborg, MariFlex and Waddenfonds.

InvaSave is fast and effective. It produces no filter backwash and requires no holding time to achieve biological efficacy. Land-based tests were conducted as if the InvaSave was a regular in-line treatment system and, in addition, the water was tested directly after treatment to verify

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Ballast Water Treatment

that the system achieves D-2 compliance in its capacity as an external treatment unit. The InvaSave has demonstrated that it can treat 'raw' ballast water from ships without any pre-treatment or settling time in the ballast tank. The latter was a requirement of the authorities prior to approval as an IMO-certified contingency measure in a port.

The system is a single-pass system and uses mechanical filtration and ultraviolet radiation to remove and eradicate invasive organisms, and has been tested in fresh, brackish and marine water, including coastal water with a high sediment load. The system is designed to be able to treat water with a low turbidity and a UV Transmission of down to 20%. The system has shown consistently that it can outperform the IMO D-2 standard for organisms.

NCL contract for Foreship

Finland's Foreship has secured a major design consultancy contract covering systems to be specified by Norwegian Cruise Line (NCL). The contract calls for independent naval architecture and marine engineering consultancy services to ensure installations on five NCL ships are fully IMO-compliant.

After an initial project involving the surveying, installation feasibility study, design drawings and documentation for class approvals on *Norwegian Dawn*, Foreship was invited to provide the same service for the Norwegian cruise ships *Norwegian Pearl*, *Norwegian Sky*, *Norwegian Jade* and *Norwegian Spirit*.

"Environmental responsibility is a core value

for NCL, and we welcomed the clarity brought by entry into force of the BWM Convention," said Giovanni Canu, VP Technical Operations, Norwegian Cruise Line. "Work to install compliant BWT systems on *Norwegian Dawn* began within a month of ratification (last September). Foreship quickly showed its value in ensuring the project proceeded smoothly to class requirements, leading us to extend to five ships. We need to manage BMT system installations effectively fleet-wide; there will be high demand once shipping moves decisively on compliance."

Foreship's full scope includes mechanical



One of the Saga fleet

and electrical design work to DNV-GL requirements, taking in diagrams for BWT systems' foundation support structures, piping routing, machinery arrangements, cabling diagrams and systems integration. Foreship is also contributing on-site installation support, where required, with the bulk of work to take place while ships are in service.

Ballast water pump sizes have varied on different ships, for example, while cabling and piping routing and penetration locations have not been uniform. Mr. Palén added that decisions on where to locate parts of the

system – above or below deck, for example – depended on space availability. Foreship was managing the NCL project via its Miami office, close to the owner's technical team. The decision reflected a wider strategic move by Foreship to develop full project management services as a separate offer to clients.

Saga Shipholding completes OBS installation

Saga Shipholding has completed the installation of Optimarin Ballast Systems (OBS) throughout its entire fleet of 32 advanced open hatch cargo vessels. In doing so, Saga has become the world's first shipowner to fit BWT systems that are USCG compliant throughout a fleet of this magnitude.

Saga originally chose BWT specialist Optimarin as its supplier of choice in 2011, installing its first system on-board *Saga Future* in 2012. Since that point it has rolled the UV-based and environmentally friendly treatment units out across its fleet, signing the contract for the final installations last May (three 2,000 m³ units for newbuilds from Oshima Shipbuilding, Japan).

"We've now enjoyed close to five years of reliable, simple and efficient BWT operation," comments Nils Otto Bjorhovde, Saga Shipholding's Hong Kong-based Technical Manager. "Saga prides itself on being a responsible shipowner and we understand that untreated ballast water is a major threat to marine biodiversity. With that in mind we took an early adopter position on BWT, thoroughly researching the segment for a market proven system that would be both effective and future proof in terms of compliance. That way we could deliver optimal value to all our stakeholders on this investment.

"We always knew we'd made the right decision with Optimarin and that was proven when they became the first company to receive USCG approval in December. We're a global shipping firm, so present and future global BWT compliance is an absolute must to ensure we can be as flexible as our customers' demands.

I'm very satisfied to say we now have that across our entire fleet."

The final installation was completed on the 47,000 dwt open hatch carrier *Saga Viking*



NCL's *Norwegian Dawn*

during a scheduled drydocking in China. This vessel, along with the rest of the Saga fleet, operates with the primary purpose of transporting pulp from South America to markets in Europe and the Far East.

Optimarin CEO Tore Andersen believes that, in addition to his firm's compliant technology, teamwork is at the heart of the Saga success. "We've been focused on BWT for a very long time now," he comments, "since we formed the business in Stavanger, Norway in 1994. So, we've spent more than 20 years perfecting the system, but also working alongside shipowners like Saga so we fully understand their individual needs and requirements. We see every customer as a partner and that, as shown in this case, is always the best foundation for a strong working relationship.

"We appreciate that shipowners want complete peace of mind with BWT – ranging from carefree installation, operation and maintenance, through to compliance with the most stringent global standards. That's what they want, so that's what we give them. There's no one else in the market that can match us in that regard."

Anglo-Eastern opens BWT training facility

Anglo-Eastern Ship Management has created a unique BWT training facility at its Manila base in the Philippines. Working in conjunction with Optimarin and Saga Shipholding, Anglo-Eastern has built an essential resource for training crews in the wake of the ratification of IMO's BWM Convention.

The facility, which officially opened this month, features a fully functional Optimarin Ballast System (OBS) at its heart, with a special pump house, piping, and practical and classroom-based learning environments. Saga, which has installed OBS systems throughout its entire fleet of 32 advanced vessels, provided logistics support for the project.

"Now that the BWM convention has finally come into force, every applicable vessel in the world fleet requires a compliant BWT system," comments Optimarin's Tore Andersen. "It's therefore vital that crews everywhere get the training they need to ensure carefree, simple and reliable operation."



(Left to right) Tore Andersen (Optimarin), Marcial Q. C. Amaro III (Maritime Industry Authority), Eivind Holte (Saga Shipholding) and Bjørn Højgaard (Anglo Eastern)

"With this in mind, we think the move by Anglo-Eastern to create this dedicated facility, in one of the world's recognised centres for maritime talent, is exactly what shipowners and operators are crying out for. The OBS is now established as the industry's preferred choice – with unbeatable compliance, including USCG approval, alongside simple installation and proven, environmentally friendly technology – so it made perfect sense utilising it as the platform for teaching these skills."

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Ballast Water Treatment

Anglo-Eastern's facility, conveniently located in the Makati central business district of Manila, is available for use by all global clients. Capt. Pradeep Chawla, who as Managing Director Group QHSE and Training heads up all training activities for the leader in specialist maritime training and ship management, says the combination of hands-on experience and technical learning sessions will provide real benefits for both students, and their employers.

The Manila facility becomes the second Anglo-Eastern Ship Management School to house an OBS, after a sister unit was installed, also in collaboration with Saga, in the firm's Mumbai centre in 2015.

"This development marks a further strengthening of the partnership we have with Anglo-Eastern and Optimarin," concludes Eivind Holte, Senior Technical Manager at Saga Shipholding. "We've worked with Optimarin as our BWT supplier of choice since 2011, ensuring the compliance and flexibility of our global fleet with their trusted UV-based and environmentally friendly units. Anglo-Eastern, meanwhile, provides full technical management for our vessels, helping us operate with optimal performance and efficiency 24/7.

"Through an initiative like this we can strengthen the skill base of our own crew and, more importantly, also help the entire industry comply with a crucial regulation. As an environmentally responsible shipowner, this is of huge significance to our company, and all our worldwide stakeholders."

Minerva contract for Wärtsilä

Finland's Wärtsilä has agreed to supply tankers managed by Minerva Marine with Aquarius BWT systems. The agreement covers the retrofit of several vessels and represents an important milestone in the BWT retrofit market.



The Wärtsilä Aquarius BWTMS

The main BWT chosen for Minerva Marine Inc. is the Wärtsilä Aquarius ATEX compliant electro-chlorination EX, which uses a proven two-stage process involving both filtration and electro-chlorination (EC). The system is EX/ATEX approved, which is a requirement for oil tankers. In addition to the main systems, the agreement includes local service support, such as training, spare parts, annual inspections and lifecycle support provided by Wärtsilä.

Minerva Marine is a private company which manages a robust fleet of VLCC, aframax, suezmax, medium range tankers and capesize bulk carriers. "The operation of vessels under our management, which involves carrying crude oil and product cargoes around the world, allows no exceptions when it comes to safety and environmental protection. Wärtsilä was able to offer a strong safety-led and reliable design approach that is expected to meet the requirements of the complex market we operate in. The possibility to get lifecycle support from Wärtsilä's worldwide service network and the BWMS' compliance within challenging environmental parameters also affected our choice of supplier," said Minerva Representatives, Stavros Daniolos, Technical Manager and Vayia Hatziyianni, Project team leader.

USCG application for Ecochlor

Ecochlor has announced it has filed an application with the USCG for Type Approval for its BWT system. Due to a far more stringent set of guidelines, type approval has only been granted to three other BWT Systems worldwide.

Upon USCG approval, the Ecochlor BWT system will extend the range of options for shipowners beyond UV and electro-chlorination technologies.

Unlike other water treatment technologies, the Ecochlor system is not impaired by variations in water salinity, temperature, turbidity, organics or vibration and does not need neutralisation at ballast water discharge. The price and size of a chlorine dioxide generator does not vary greatly based on flow rate. As a result, chlorine dioxide generators are much more economically viable over other systems in the treatment of large volumes of water. Additional advantages are that the Ecochlor system has one of the lowest power consumption technologies, if not the lowest, on the market today.

Tom Perlich, Ecochlor president and founder, commented, "The Ecochlor chemistry works just as effectively now as it did more than 12 years ago with our first installation. The only change was that we reduced the chemical dosage for USCG TA. These fully independent test results clearly indicate that the Ecochlor system will meet and, in most cases, exceed USCG discharge criteria." "Based on our extensive knowledge in regulatory compliance and relevant installation project experience for complex tanker retrofits," adds Perlich, "we are receiving orders from major shipowners who are interested in having their vessels satisfy the highest environmental standards."

Since the first Ecochlor system was sold in 2004, it has undergone extensive testing for approvals, and has received IMO Type Approval in 2011, as well as numerous classification society approvals including Lloyd's Register, American Bureau of Shipping, Class NK, Bureau Veritas, and RMRS. DNV GL was selected as Ecochlor's Independent Laboratory (IL), in order to secure DNV GL classification society approval simultaneously with USCG Type Approval.

Alewijnse offers various systems

Holland's Alewijnse Marine, piping specialist Leemberg and 3D (EX) scanning specialist Medir International have entered into a frame agreement for the delivery within Europe of BWT systems for several leading manufacturers.

For these worldwide BWT systems producers, using electrolysis, UV, chemical and other technologies to neutralise invasive marine organisms found in ballast water, Alewijnse is responsible for integrating the BWT systems into each ships' existing systems, including cabling.

Leemberg is responsible for integrating the components and piping into each ships' existing ballast systems and Medir will scan the engine and pump rooms 3D (EX) of client vessels prior to installation to determine the optimal positioning and layout.

The long-standing practice of taking on ballast water to maintain the structural integrity of the hulls and regulate the draught of seagoing vessels has been identified as a major factor in invasive micro-organisms migrating from their original habitats to foreign waters where they may overwhelm native species. **SORJ**

Ballast water bill likely to exceed all expectations

The big tanker fleet is larger than it has ever been. At the beginning of April, there were 715 VLCCs in the 200,000 dwt-plus category with another 90 units on order, equivalent to 13% of today's fleet capacity of 220m dwt. Corresponding figures in the Suezmax range were 528 tankers between 125,000 dwt and 200,000 dwt, with another 77 on order. The orderbook in this category represents nearly 15% of today 82.3m dwt fleet, according to figures from Clarkson Research Studies.

It is the owners of these large tankers, together with dry bulk and large gas carrier operators, who have potentially the most to lose from the IMO's Ballast Water Management Convention (BWMC), due to enter force during September this year. They face significantly more serious risks as compared with other sectors for various reasons.

Firstly, the cost of installing ballast water treatment systems across a fleet of VLCCs will generate a bill running into many millions of dollars.

Estimates vary, but an installed treatment system, fit for purpose on a large tanker, is likely to cost \$1-2m. And there is no potential payback, other than the ability to continue trading.

No-one yet knows the number of ships which will be retrofitted with treatment systems but overall, there could be as many as 40-60,000 vessels requiring systems over the next few years. Clarkson's database recently listed 250 shipyards and 520 drydocks with potential installation capacity. But when demand peaks, there are likely to be shortages of repair capacity, hardware, pre-installation engineering planning and installation expertise.

Secondly, on debt-free older tankers, profitable operation will be materially affected by this investment. Assuming a \$2m bill, all-in, the cost of a treatment system over five years works out at about \$1,250 every day. For some owners, a decision to make this investment on a 15-year-old vessel may be marginal, and this could generate a growing number of VLCC and Suezmax scrap sales. Clarkson figures reveal that there are about 200 crude tankers in the Suezmax and VLCC sizes which were built in 2000 or before.

Thirdly, there are a broad range of operational risks which, according to some experts, have not yet been fully understood by all ship operators. These risks not only apply to retrofits, but also to new vessels equipped with treatment systems that are not fit for purpose. This is because robust systems with IMO type approvals have been copied in parts of Asia and these systems may fail to meet the discharge standard when they are put into operation following installation.

The outcome, according to some sources, could be delays to ships, financial penalties, periods of off-hire and even a requirement in some port states for ships to leave the berth, sail to international waters, de-ballast, re-ballast and return, prior to working cargo. Access to a suitable berth could be delayed for days.

There are also cases where some Asian shipyards have demanded huge premiums to install treatment systems of the owner's choice, rather than the standard equipment on which the yard has negotiated a bulk supply deal. Reports indicate that some owners have accepted the shipyard's choice of system, only to replace it after delivery, as a cheaper option.

For owners of large tankers, there are a set of other challenges. Ballast pumping capacity, power requirements on board ship, filter blockages and resulting delays, and weak electro-chlorination systems all pose the

costly risk of operational disruption. If ballast water discharge standards fail to meet requirements on several occasions, ships and/or their operators could get blacklisted, with more rigorous inspections every time their ships arrive on a terminal. Treatment systems themselves could also get earmarked for special attention if their performance has been shown to fail on several occasions.

One of the biggest issues, however, which ballast water system manufacturers don't like to talk about, is the issue of in-tank organism re-growth during a long ballast voyage. Most large tankers – and bulk carriers, for that matter – are deployed on long-haul routes.

Coldharbour Marine, a UK-based BWT manufacturer in the UK which has developed a unique patented technology based on inert gas, wrote to IMO Secretary General Kitack Lim last year to point out the shortcomings of both the IMO and the US Coast Guard (USCG) testing protocols with respect to the re-growth issue.

The IMO's testing procedure only requires ballast water to be held for five days before it is checked for organism content. The USCG's protocol lays down a holding time of just one day. But, as the Coldharbour Marine letter pointed out, thousands of ships are deployed on ballast hauls lasting much longer than five days. During the rest of the ballast voyage, after five days, any surviving organisms could reproduce and multiply, feeding on millions of dead ones in the tanks. There is a distinct possibility, therefore, that a treatment system with either IMO and/or USCG type approval, could fail to meet the discharge standard at the end of a long ballast voyage.

Some fear, therefore, that the BWMC could end up costing global shipping – particularly the owners of large ships with long ballast hauls – very much more than merely the systems themselves and their installation costs. So the message is clear. Cutting corners to save money on cheaper systems now could turn out to be a very expensive mistake. Time will tell. **SORJ**



KOTC has already gone through a 'scanning and engineering' process carried out by ASRY for installation of BWT systems in the future