

Ballast Water Management: Industry Leading the Way

Innovation Out in Front of Regulatory Oversight

By Joseph Keefe

According to U.S. Coast Guard (USCG) Admiral Ronald F. Silva, “The problem of invasive species is the highest priority marine environmental issue for the U.S. Coast Guard.” He adds that while the problem is certainly not confined to the Ninth District (the Great Lakes), the area – being a source of drinking water for 37 million North Americans – potentially has the most at stake in this regard. These comforting words should give hope to the maritime community at-large as it struggles with the quandary of deciding what – if any – ballast water treatment system it should install or retrofit onto its oceangoing fleets. Unfortunately, Silva spoke these words during the first quarter of 2003. More than four years later, there has been arguably little progress from the federal government on the issue of aquatic invasive species and, in the face of this perceived inaction, unilateral action on the state and local level has only worsened a growing crisis.

The Great Debate

Congress last took action eleven years ago by amending the 1990 act with the National Invasive Species Act of 1996. Washington attorney Larry Kiem, our “Washington Insider,” perhaps says it best when he writes, “Since then, Congress has struggled to resolve the substantial differences of opinion about how best to combat, either politically or technologically, the aquatic invasive species introduced through ballast water.” While it debates the issue, individual states such as California and Michigan have taken matters into their own hands. Frustrated by inaction, the local measures serve to turn up the heat on the federal government to act. This year, substantive efforts to come to some sort of agreement have been made. Congressman Oberstar (D-MN) has proposed tying these initiatives to the Coast Guard Authorization Act, the leading legislative vehicle for enacting maritime measures. To date, though, none of the efforts

at the federal level has yielded fruit, and we are left with state-specific regimes which do little to combat invasive species and everything to cripple local commerce.

There is more bad news for shipping interests, however. As *MarEx* goes to press with this edition, a federal judge dismissed a lawsuit by nine shipping companies and trade associations that had attempted to overturn the Michigan law that mandates deep-draft, oceangoing vessels to treat their ballast water. As the court ruled that Michigan’s law is constitutional, the door opened for any number of other states, some of whom were waiting to see the outcome of this particular case – Minnesota, Wisconsin and Indiana, just to name a few – to pass similar ballast water treatment laws.

On the federal level, the hits just keep on coming. The 2005 decision of the United States District Court for the Northern District of California striking down the EPA’s long-standing exemption of discharges “incidental to the normal operation of a vessel” has given the EPA only until September 2008 to promulgate National Pollution Discharge Elimination System (NPDES) permit regulations for operational discharges, including ballast water discharges. And Senator Barbara Boxer’s (D-CA) recent efforts in Washington have only made EPA involvement in the mix more likely. Boxer has proposed letting the states regulate their own ballast water issues, independent of the Coast Guard, effectively eliminating it from the regulatory function and placing the matter of ballast water treatment and management under the Clean Water Act.

Progress From the Coast Guard: Slow, But Measured

According to the U.S. Coast Guard’s Rich Everett, environmental protection specialist in the Coast Guard’s Environmental Standards Division, a rulemaking effort is underway at headquarters. This includes progress in defin-

ing a ballast water management standard. A proposed list of options will be issued, says Everett, “in late summer or early fall, after which there will be a public comment period.” All of this will then be used to formulate a proposed standard, which again must go through a comment period. Everett defends the Coast Guard’s progress on the way to achieving a defined standard by saying, “We’ve come a long way in achieving a system to evaluate the diverse technologies necessary to test these ballast water systems.”

With regard to the rulemaking effort, Everett says, “We don’t talk in time frames.” But he says measured progress is being achieved. He points to the Coast Guard’s Shipboard Technology Evaluation Program (STEP), which (a) helps technology developers test their systems and incentivizes ship operators to install equipment without fear that the equipment will be declared inadequate down the road when and if a standard is defined, and (b) provides the Coast Guard and the general public with high-quality information and data about how the systems work and how well they achieve the desired results.

Currently, there are three applications outstanding for the STEP program, although Everett again admitted that he could give no timetable on when decisions might be made on any of them. In the end, a vessel and technology admitted to the STEP program would have the equipment that was installed on that particular vessel grandfathered for life, no matter what the ultimate standard might be. That vessel also has the option to forego mid-ocean ballast water exchange as long as it treats its ballast water with the system installed. For newbuild vessels, this program would also remove the fear of installing equipment that would later be declared unacceptable. For a vessel intending to trade in the Great Lakes and/or call at any Michigan port in the near future, the program might just be the right ticket.

Rich Everett says that the Coast Guard will move forward in trying to define a standard, regardless of what happens at the EPA or other federal agencies. In the meantime, industry is not sitting on its hands.

Industry to the Rescue

The best opportunity in over a decade for congressional reform may be quickly slipping by the boards. Beyond this, the matter of coordinating any U.S. action on the matter with International Maritime Organization (IMO) efforts to standardize what constitutes adequate ballast water treatment (BWT) will be daunting. Sadly, the technology to do just that is already here. A few forward-thinking shipping companies have already had the courage to install this equipment and the early data show real promise. And more than a few manufacturers have entered the fray with their own customized and patented systems. The cost of these systems, as a general rule, can fluctuate from around \$300,000 to as much as \$1 million to put on board.

As one ballast water treatment executive (who asked not to be identified) told *MarEx* recently, "It's not the competition that keeps us awake at night – it's the government and the regulations." The implications are obvious: There will be plenty of business to go around, once the regulations are defined, to any number of companies with the know-how to meet those standards. As for the shipping companies, they know the day is coming and few are complaining about the cost of purchasing and installing the devices – they just want to know what that technology will entail. Just as shippers plying the Great Lakes are reluctant to install expensive ballast water treatment systems to meet what may be a fleeting local regulation, so too are the commercial vessels engaged in international trades. That having been said, *MarEx* took the opportunity of our annual environmental issue to look at just a few of the devices represented by this emerging technology.

Alfa Laval's PureBallast System

Alfa Laval recently introduced its "PureBallast System," a fully-automated ballast water treatment system. This newly-released, chemical-free method further strengthens Alfa Laval's already environmentally-friendly reputation. At a press conference held at this year's Seatrade Cruise Shipping Convention in Miami, Alfa Laval provided details of its newest product.

According to Alfa Laval, the PureBallast

system works much the same way during ballasting and deballasting procedures. Water is treated by at least one Wallenius AOT (Advanced Oxidation Technology) unit, Alfa Laval's patented AOT technology developed with Wallenius Water, which contains titanium dioxide catalysts that, when contacted by light, generate hydroxyl radicals. These radicals "break down the cell membrane of microorganisms – without the use of chemicals or the creation of harmful residuals." After its short, "few milliseconds"-long life, each radical becomes a water molecule. This process was described as a "from nature to nature" approach by Pauli Kujala, a spokesperson for Alfa Laval at a press conference during the Seatrade Convention on March 14.

PureBallast, which has met the stringent IMO ballast water requirements in pilot tests supervised by Det Norske Veritas (DNV), is well underway with the year-long official approval process. Alfa Laval strengthens its portfolio of equipment for protecting marine ecosystems with this chemical-free system for removing potentially invasive species from ballast water. PureBallast, arrives well before the IMO regulations on ballast water treatment take effect in 2009.

PureBallast is fully backed by Alfa Laval's global network of service and support. Since well before 2004, when the IMO convention on ballast water was adopted, Alfa Laval and many other companies have been working to develop an IMO-compliant treatment system. At present, there are no well-established marine testing facilities to perform the full-scale, land-based tests, but the Norwegian Institute for Water Research (NIVA) is expanding its operations with four new tanks of over 200 m³. Alfa Laval, which has worked closely with NIVA on the ballast water issue, chose the Institute to perform its pilot studies.

To ensure a comprehensive solution, Alfa Laval set specific goals when planning the PureBallast system. "Besides being determined to meet the IMO legislation," Kujala says, "we were determined to do it without the use of chemicals." Avoiding chemicals was not only an environmental decision but also a way of ensuring that nothing extra would have to be stocked or handled on

board. Even very small amounts of chemicals add up quickly when dealing with large ballast water volumes. In general, the PureBallast system was designed to have a small footprint and to be easily installed and maintained. In addition, it was decided that PureBallast should be fully automated and have a lifetime corresponding to that of the vessel.

The finished PureBallast system is compact and fits well in the engine room – its block structure allows it to be installed between the normal ballast water system components. Moreover, the system is simple to operate, and the treatment of water with PureBallast occurs in two stages: pre-treatment and end-treatment. During ballasting, water passes through a pre-filter to remove any larger particles and organisms. The water then continues to the AOT unit, which produces radicals that effectively break down smaller organisms that have



Alfa Laval's PureBallast System

Technical Superintendent

Rio De Janeiro, Brazil

Int'l Ship Mgmt. Co. seeks Technical Superintendent to oversee its DP1 PSVs. in Brazil.

Min. req'd. Chief Engineer's cert., + 2 yrs exp as Chief Engineer on PSV. Exp in Brazilian ops., Spanish/Portuguese lang. preferred. Good comp. pkg/ medical/retirement benefits.

E-mail Resume to: resourcesc@gmail.com.

passed through the filter. Sediment buildup in the ballasting tanks is avoided thanks to the pre-filter stage, and any backflushing water is returned to the ocean directly at the ballasting site. During deballasting, water again passes through the AOT unit in order to destroy any organisms that might have regrown in the tanks during the voyage. The filter, on the other hand, is bypassed, thus avoiding any filter back-flushing – eliminating the risk of contamination via the filter at the deballasting site. The whole chain is fully automated with monitoring alarms and the possibilities for both local and remote operation.

While the pilot tests are convincing, ship-owners and operators will be pleased to know that PureBallast has also been tested at sea. Since 2003, a full-scale prototype of PureBallast has been operating aboard a transoceanic vessel, the Wallenius car carrier *M/V Don Quijote*. Installed as a retrofit, the system aboard the *Don Quijote* has been tested not only for biological efficiency but also for automation and operating reliability. Among other things, it has shown that PureBallast does not interfere with ballasting operations and can handle both harsh conditions and varying flow. Based on the favorable results from the *Don Quijote*, an additional PureBallast installation was made on board the newbuild *Aida* in 2006. A third installation, also on board a newbuild, will be made during the course of the autumn. The comprehensive testing to be done on board these installations will help to confirm the calculated operating costs. Additionally, Alfa Laval says that six other installations are planned on newbuild tonnage originating in both China and Korea.

Alfa Laval is listed on the Nordic Exchange (Nordic Large Cap) and in 2006 posted annual sales of about SEK 20 billion

(approx. 2.2 billion euros). The company has some 10,000 employees.

Visit Alfa Laval at www.alfalaval.com.

Hyde Marine Ballast Water Treatment System

The Hyde Marine Ballast Water Treatment System (BWTS) offers an effective and reliable solution based on solids separation and UV irradiation. The Hyde Marine System utilizes existing ballast pumps and piping. Standard systems are available for flow rates from 100 m³/hr up to 3,000 m³/hr.

The Hyde Marine BWTS is optimized for each particular vessel design and operating condition. The system includes appropriate pre-treatment to remove solids and large organisms. For smaller ballast systems and applications where high solids removal is desired, the Arkal Filter is economical and practical. The Aquionics UV destroys or inactivates biological organisms, including zooplankton, algae, bacteria and pathogens from ballast water without affecting the normal operation of the ship. Ballast water is also treated during deballasting to ensure the maximum effect.

Key benefits of the Hyde Marine system, according to Tom Mackay of Hyde Marine, include low cost, simplicity, high reliability, minimum operator attention, turnkey delivery, integration into existing ballast systems, no chemicals and modular installation.

In January, Hyde Marine announced the installation of its seventh full-scale BWTS aboard Royal Caribbean Cruise Lines' *Celebrity Mercury*. The system was installed by the ship's crew and had no effect on the ship's normal operations. Hyde Marine has been involved in ballast water treatment since 2000, when the initial first-generation system was installed aboard Princess Cruise Lines' *Regal Princess*. In 2001 four additional full-scale systems were installed, two on cruise ships and one each on a container ship and chemical tanker. In the spring of 2003, after the requirements were better defined, Hyde supplied an upgraded filtration and UV disinfection BWT system for the *Coral Princess*. This system was tested extensively both on land and aboard the *Coral Princess* in the fall of 2004.

The onboard tests dem-

onstrated the Hyde BWTS's capability to meet the IMO BWT Convention requirements. The *Mercury's* system is essentially identical to the Hyde system aboard the *Coral Princess*. All seven systems were commercial transactions. The newest version of the Hyde BWT System has been fully commercially available since 2003. Hyde Marine can be found on the Internet at www.hydemarine.com.

Ecochlor

Ecochlor Inc., www.ecochlor.com, founded in 2001, has developed proprietary ballast water treatment systems that have been specifically designed to safely and economically eliminate the worldwide transfer of aquatic invasive species. Ecochlor is a privately-held corporation with headquarters in Acton, Massachusetts.

Ecochlor's systems provide shipowners with a cost-effective, environmentally-acceptable treatment system that will comply with all enacted and proposed standards and regulations. In-house experts and a team of strategic partners not only design and manufacture the Ecochlor™ Ballast Water Treatment System but also supply marine engineering, naval architecture, chemical treatment expertise, shipboard installation and ongoing technical and regulatory certification support. Ecochlor says that it currently provides sales, service and technical support for the system with personnel in North America, Japan, Korea, China, Greece and Sweden.

Ecochlor's treatment methodology utilizes the unique properties and benefits of chlorine dioxide, and the company received broad U.S. patent coverage in August 2004. Since that time, the company has received patents in Korea, Singapore and Australia, and other international patents are pending. Chlorine dioxide has been used safely and effectively in industrial and municipal water treatment applications for over 50 years but has never been applied to seawater or in any shipboard applications. In research underwritten by Ecochlor at the University of Rhode Island Graduate School of Oceanography, the use of chlorine dioxide was proven effective in seawater on representative groups of all target organisms. Ecochlor, furthermore, has obtained an exclusive worldwide license from Eka Chemicals, www.purate.com, for the use of its proprietary precursor chemicals and generation technology to produce chlorine dioxide.

Ecochlor's system generates a dilute solution of chlorine dioxide that is injected into the main ballast water line as ballast is loaded.



Hyde Marine Ballast Water Treatment System



Ecochlor's proprietary ballast water treatment system

company applied to the U.S. Coast Guard for acceptance of these systems into the Shipboard Technology Evaluation Program. Acceptance into this program will provide an equivalence to any current or future U.S. Coast Guard regulations for ballast water treatment (no more ballast water exchange). Ecochlor could be the first company to receive USCG STEP approval, and this is expected in the fourth quarter of 2007.

of invasive species, but they can't move the technology forward until there's a standard to build to and apply to saltwater vessels." In the time that has passed since he made this statement, not much has arguably changed in terms of legislative and regulatory oversight. Fortunately, the marine industry has steadfastly ignored this roadblock and has moved the technology forward.

Although the IMO's approval process is much further along than any federal standard being contemplated in the United States, not all member states have ratified that standard. And the standard being tossed around in

The process only requires a small injector into the ballast water line; no re-piping of the ballast system is necessary. The Ecochlor™ System is small (less than 7.5 m² for a 2,500 m³/hr capacity) and can be located anywhere on the ship. It does not need to be located in the engine room where space is typically limited. The process is fully automated, and the crew will not need to make any adjustments to their ballasting procedures. Ballast can be effectively treated through gravity feed or pumping, and the dosage is automatically adjusted for slow or fast ballasting.

After injection, a small chlorine dioxide residual remains in the ballast tanks to neutralize any biofilm that may be in the system. With its short half-life, the chlorine dioxide residual decays below detection limits within hours of treatment, and the treated ballast water can then be safely discharged.

On July 29, 2004 the company's first system was installed on Atlantic Container Lines, M/V *Atlantic Compass*, one of the world's largest combined Container/RORO (roll-on/roll-off) ships. This ship is a Swedish-flagged vessel that carries cargo between Europe and North America. In July 2005, the company installed its second system on the bulker M/V *Moku Pahu*, operated by Matson Navigation, www.matson.com, that carries sugar from Hawaii to the West Coast and grain to Asia. In 2006, the

"It is clear that carriers want to solve the problem of invasive species, but they can't move the technology forward until there's a standard to build to and apply to saltwater vessels."

Looking Ahead – Achieving Workable Policies

The three technologies listed above by no means represent all that industry has to offer. As many as eight different firms, large and small, are either in the process of developing technologies to deal with invasive species or already have working prototypes aboard various classes of commercial vessels. Beyond this, the ports of Los Angeles and Long Beach are teaming up with another shipping line to test a shipboard ballast water treatment system designed to remove non-native species from ballast water. This is truly a time when industry, tired of waiting for governments to come up with substantive, defined and unified standards, has decided to move the ball forward itself.

Jim Weakley, President of the Lake Carriers Association (LCA), said back in 2003, "It is clear that carriers want to solve the problem

Washington is said to be somewhat tougher to achieve. Marrying the two benchmarks together will likely evoke memories of the implementation of OPA 90 regulations on foreign tonnage trading in U.S. waters.

Eventually, long-time operators like Hyde Marine and Ecochlor are hopeful that the Coast Guard's STEP program, using their equipment and partner shipping companies, will help to provide data that will yield a defined standard in the not-too-distant future. Still others, like industry heavyweight Alfa Laval, are focusing on the already-defined IMO approvals first. Either way, and notwithstanding the apparent lack of progress on the domestic front, a ballast water management standard will be achieved. The only questions left to be answered are when and what that standard will be. Industry looks to be ready to take it from there.

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