Alfa Laval's PureBallast 2500 serves aboard *Stena DrillMAX ICE.*

Ballast Off a Sinking Ship: The Plot Thickens...

By Joseph Keefe

As individual states bicker over a myriad of different ballast water management protocols and the federal government inches forward in its quest for a national standard, the influx of invasive species continues. A unified global standard is possible before the end of 2010. Will it happen and – more importantly – if it does, will the balkanized U.S. approach to the problem end?

TWO STEPS FORWARD, ONE BACK...

Midway through the first quarter of 2010, the pace has quickened noticeably in the national battle to control and eradicate invasive species and prevent still others from reaching U.S. waters. In the continued absence of an approved federal standard, as many as a dozen individual states have enacted or are actively contemplating their own statutes. Add to that mix the proposed federal standard announced by the U.S. Coast Guard in August 2009 and some industry observers are predicting a resolution of the issue before the end of the year. Good news, indeed, right? Not so fast…

The absence of a federal ballast water treatment (BWT) standard has been a nightmare for more than a decade. Frustrated by inaction on the federal level, individual states have separately enacted their own standards. The collective result has been a hodgepodge of balkanized state rules that – often in close proximity to one another and sometimes other countries – have had little or no effect on the effort to stem the tide of invasive species.

SHOTGUN SOLUTIONS: KILLING COMMERCE, NOT FISH

In some cases, local rules have discouraged vessels from calling in particular states because owners are unwilling to install expensive abatement equipment that might not be approved when the final BWT rules are eventually established. In Michigan, for example, where the local economy has been on life support for a decade, a local BWT statute did little to stop the ingress of invasive species from adjacent waters and accomplished nothing beyond hindering local commerce at a time when the Great Lakes state could ill afford it. As MarEx went to press for this edition, environmentalists were pushing Wisconsin officials to get tougher on vessel ballast water in their state.

Wisconsin already calls for controls on oceangoing vessels that are 100 times more restrictive than the International Maritime Organization's (IMO) standards, which the Coast Guard hopes to mimic – at least in phase one of its proposed solution. If the technology isn't available to meet that, the vessels must abide by IMO limits. That's just not strict enough, says the National Wildlife Federation. Yet the technology to test equipment and ballast water to that lofty standard does not yet exist.

To say that the competing standards are confusing and wide-ranging would not give justice to the actual situation in play right now. And, according to the EPA, Ballast Water treatment standards with compliance schedules are incorporated by at least 8 states (California, Illinois, Indiana, Ohio, Michigan, Minnesota, New York, Pennsylvania). Furthermore, standards range from IMO equivalent (IL, IA, MN) to California and Pennsylvania (zero detectable organisms above 50 microns), and include the "Michigan Approach" (must use select treatment approaches; e.g., hypochlorite). Some states require exchange without deviation allowances (e.g. New York). Some states are requiring Atlantic Nearshore Exchange and Flushing (e.g., Massachusetts and New York). Connecticut requires use of a treatment system if installed for any reason (e.g., STEP, to meet IMO conditions, or to meet 401 certification conditions for any other state).

Perhaps no state is approaching the issue more aggressively than California. Calling for a standard which is virtually 1,000 times more restrictive than the IMO's, the Golden State is, in reality, moving toward a standard which would eventually prohibit the discharge of any ballast by any vessel. In the same breath, CA regulations also warn that "Nothing in this provision relieves the master, operator, or person in charge of a vessel of the responsibility for ensuring the safety and stability of the vessel or the safety of the crew and passengers, or any other responsibility." That the previous two sentences are at loggerheads with one another does not seem to enter the thought process of California regulators.

SITREP: 1Q 2010

The August Coast Guard announcement of proposed standards (http://media.tmmarket.com/marex/media/pdf/Ballast_Water_

Table 1: Comparison of Ballast Water Limits (Courtesy of EPA)

Mark Note – the "100 x" and "1,000 x" refer only to the "≥ 50 µm" and the "< 50µm, but ≥ 10 µm" size groupings.

NARRATIVE DESCRIPTION	Size: ≥ 50 µm	Size: < 50µm, but ≥ 10 µm	Bacteria	Viruses
"IMO"	< 10 living organisms per m^3	< 10 living organisms per ml	**Vibrio cholera:** < 1 CFU per 100 ml **E. coli:** < 250 CFU per 100 ml **Intestinal enterococci:** < 100 CFU per 100 ml	—
"100 x IMO"	< 0.1 living organisms per m^3	< 0.1 living organism per ml	**Vibrio cholera:** < 1 CFU per 100 ml **E. coli:** < 126 CFU per 100 ml **Intestinal enterococci:** < 33 CFU per 100 ml	—
"1000 x IMO" 1	< 0.01 living organisms per m^3	< 0.01 living organism per ml	**Vibrio cholera:** < 1 CFU per 100 ml **E. coli:** < 126 CFU per 100 ml **Intestinal enterococci:** < 33 CFU per 100 ml	—
"CA Interim Standards"	0 detectable living organisms	< 0.01 living organism per ml	**Vibrio cholera:** < 1 CFU per 100 ml **E. coli:** < 126 CFU per 100 ml **Intestinal enterococci:** < 33 CFU per 100 ml < 10^3 bacteria per 100 ml	< 104 viruses per 100 ml
"CA Final Standards"	0 detectable living organisms	0 detectable living organisms	0 detectable living organisms	0 detectable living organisms

NPRM_082809.pdf) for BWT, an effort that was as many as ten years in the making, drew mixed reviews from industry, environmentalists, manufacturers of BWT equipment and the people who ultimately test and certify these devices. Long awaited by a host of maritime stakeholders here and abroad, the first phase of the proposed rule falls short of certain local standards but provides general agreement with an IMO standard that has been in place since 2004. Nevertheless, the Coast Guard proposal represents progress and provides clear guidance to shipowners who were previously reluctant to do much of anything in the absence of any standard on this side of the pond.

The Federal Register entry includes feasibility studies and the possibility of revising the standards to a stricter benchmark in the future. The technology to test with certainty to the stricter phase two standards (which many states want to set as the benchmark) does not yet exist. Furthermore, it is unclear as to when, if ever, this will be possible. Last month, at the Maritime Environmental Resource Center (MERC) on Maryland's shores, Dr. Mario Tamburri told *MarEx*, "All in all, the Coast Guard's proposal represents a reasonable and logical approach." Tamburri, MERC's Director, has been involved in the study of invasive species and the testing of BWT devices for more than ten years.

There is more good news: The phase-two standard also includes a "grandfather clause" for those vessels that install tech-


DR. MARIO TAMBURRI

nology that has been type-approved as meeting the phase-one standard prior to January 1, 2016. Although it is unclear whether the proposed grandfather clause would survive or even be further extended (through the input received in the comment period), it does provide immediate hope that those shipping companies who choose to install equipment will not be bitten on the back end by a stricter standard.

The Coast Guard's comment period on the proposed measures is now over. Over the course of as many as six public hearings on the matter, more than 400 comments were received. Next on the Coast Guard's plate – beyond approving the proposed standard – will be to develop a testing protocol and, finally, proceed with the certification of technology/equipment that meets the standard. It is entirely possible that certification of individual pieces of equipment will take the form of accepting "equivalencies to IMO and/or other flag-state approvals."

When Michigan lawmakers jumped the gun two years ago with their own localized statutes to combat invasive species, they achieved little except to balkanize an already complicated process. In the rush to eradicate one set of pests, local laws failed to consider the ramifications of six or seven ships simultaneously discharging, for example, hundreds of thousands of tons of deoxygenated water into a small harbor. Add other variables such as chlorine, UV, ozone, and every other treatment program now under consideration, and the environmental impact of these solutions alone have rightly given many pause. The process, therefore, rightly went through the necessary EIA and NEPA reviews required by the system.

Dr. Rich Everett of the Coast Guard's Environmental Testing Division told *MarEx*, "We are coming to the end of that process." He adds, "These are necessary steps, required by the system. Procedures need to be followed and there are good reasons to do just that." The process, perhaps the most far-reaching ever attempted by the Coast Guard, may be coming to an end – or, perhaps, as Winston Churchill might have put it, "the end of the beginning."

REAL SOLUTIONS, READILY AVAILABLE

The methods being used to attack invasive species in ballast are many. The options being considered, with some already approved by regulatory bodies, include:

- *Mechanical methods, including filtration and separation;*
- *Chemical treatment methods (biocides, chlorine, etc.);*
- *Physical treatment methods such as sterilization (ozone, electric currents, UV light and heat), and*
- *Various combinations of these methods.*

MERC's Tamburri provided advice (see Table 2) on individual technologies and manufacturers who are already one step ahead of the game as a U.S. standard nears finalization. The eight

Table 2: Approved BWT Technology/Equipment (1Q 2010)
Source: Maritime Environmental Resource Center (based on information gleaned from IMO).

Manufacturer	Treatment Name	Treatment Type	Type Approval Certification
Alfa Laval (Sweden)	PureBallast	Filtration + Oxidation	Norway
Hamann Degussa (Germany)	SEDNA System	Hydrocyclone + Filtration + Peracetic Acid (Peraclean)	Germany
Hyde Marine (USA)	Hyde Guardian	Filtration + UV	UK
NEI Treatment Systems (USA)	Venturi Oxygen Stripping	Deoxygenation + Cavitation	Liberia, Malta & Marshall Islands
NK-03 (USA/Korea)	NK-03 BlueBallast System	Ozone	Korea
Oceansaver AS (Norway)	OceanSaver BWMS	Filtration + Cavitation + Nitrogen Supersaturation + Chlorination	Norway
OptiMarin (Norway)	OptiMarin Ballast System	Filtration + UV	Norway
Techcross (Korea)	Electro-Cleen	Electrochlorination	Korea

manufacturers listed use almost as wide a menu of technologies as the list of approval certifications.

There is one thing that we do know for sure: *The technology to meet the IMO standard exists today*. And that's good news for the eight equipment manufacturers who have already met IMO or flag-state standards and as many as ten more literally knocking on the door. As the maritime industry recovers in parallel with the world's financial markets, the installation of this soon-to-be-required equipment will probably add some juice to the rebound.

NO SILVER BULLET: CHOOSING THE RIGHT SYSTEM FOR THE RIGHT SHIP AND TRADE ROUTE

Tamburri provides a word of caution for those who would move forward to install a particular piece of equipment. As the director of a facility that has demonstrated the capability to test and benchmark this new technology, he says, "There is likely no silver bullet. What works for one ship type, size or trade route might not be appropriate for another." Indeed. The list of approved devices includes technology that treats ballast water using filtration, hydrocyclone, peracetic acid, UV-treatment, deoxygenation and chlorine. One device even incorporates almost all of these technologies or, as one observer put it, "everything but the skin diver with a spear." Approvals also come from a myriad of sources, including Norway, Germany, the UK, Liberia- and Marshall Islands-flag, Malta and Korea.

There is no one perfect solution for all vessel types, operations or routes. In general terms, certain technologies may be better suited for certain trade routes, ship size and the service involved. Suffice it to say that all of the approved technologies have their place in the mix. And while Table 3 is not meant to contain the definitive list of what technology works best with which ship, early

Table 3: Possible BWT Considerations for Vessel Trade, Routing, Size, etc.

Type of Technology	Ship/Service/Route/etc.	Remarks
Filtration/UV	Cruise/Military Applications	Typically involves lower flow rates, no chemicals, and speed of ballasting OPS not typically a major issue.
Deoxygenation	VLCC/ULCC/Large Bulkers	Flow rate of ballast water is a critical variable – large volumes handled make in-tank treatment desirable.
Filtration + Electochlorination	Midsize Vessels/Containers	A combination approach might work best.
Deoxygenation/Filtration-UV and/or other chemical treatments	Fresh Water or Brackish Service	Brine needed for electrochlorination.
Filtration/UV	Short Transit Time/Coastwise OPS	Perhaps not enough time for deoxygenation and/or chemical treatments.

testing results have given rise to certain trends, realities and common-sense discoveries that operators *might* want to consider:

Other variables include maintenance issues, how complicated the device might be to operate, and the materials (chemicals, etc.) that might be needed for a particular technology. For example, a newbuilding vessel which installs a BWT device using chemicals might be fitted from the outset with seals, piping and valves designed to handle that mix. The long-term effect of chemicals on seals, valves, coatings and lubrication for an older vessel which retrofits that same type of equipment is as yet unknown. With as many as 50 players vying to provide BWT equipment, a myriad of factors needs to be considered before opening up that checkbook, including but not limited to:

- *Service area of vessel – fresh, brackish, or salt water;*
- *Length of trade route – time of ballast in tanks (settling/treatment considerations);*
- *Where ballast is loaded – muddy, clear, or high concentrations of sediments;*
- *Deballasting speed – important for tankers and bulkers on time and spot charters;*
- *Tolerance for sediment in tanks (effect on DWT capacity, cargo ops, etc.);*
- *Viability of BWT manufacturer – financial strength, staying power, international reach (maintenance).*

The flag-state approval of a particular technology will not end the debate. For example, the chlorination of ballast water certainly is a viable BWT method, but implicit with that system is the cost of chlorine. On the other hand, filtration or UV systems come with other costs: fuel and electricity expenses. As operators begin the process of choosing which system to employ, they'll have dozens of variables to plug into the equation, not the least of which will be the cost of installation. Tamburri says flatly, "The fewer the moving parts and components, the better." And from a mariner's point of view, a single, simpler approach can make more sense – if it works.

WHAT'S NEXT

No state owns the patent on impatience when it comes to solving the BWT problem. But, like another five or six states working on similar protocols, their collective efforts might just be what prevents swift (that's a relative term here) implementation of an amicable standard. The fly in the ointment will therefore come at the state level in America. Just as many of these individual states acted out of frustration over the lack of federal standards in the first place, it is also possible that the less-strict standards contained in phase one of the Coast Guard proposal will cause them to dig in their heels even further.

The proposed rules do not prevent individual states from imposing stricter standards. On the other hand, no one has yet demonstrated an ability to test with certainty to assure compliance with phase-two levels. For his part, MERC's Tamburri says, "I hope the states will recognize this on the federal level and embrace this fundamental approach." He goes on to say, "Working with the international community, this starts solving the problem now. The stricter standard should be the ultimate goal, but the IMO standard is a great place to start."

In 2003 U.S. Coast Guard Admiral Ronald F. Silva told *MarEx*, "The problem of invasive species is the highest priority marine environmental issue for the U.S. Coast Guard." Seven years later the Coast Guard finally put some teeth into those claims by publishing – although not without controversy – a logical set of proposed rules to deal with the problem. The maritime community's quandary over what – if any – BWT system it should install or retrofit onto its oceangoing fleets may be nearing its painful conclusion. That said, this will without a doubt be predicated on the stakeholders – local, federal and international authorities, along with environmentalists – embracing the proposed standard. That's a variable, unfortunately, that can't be predicted with any certainty. At least not yet.

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