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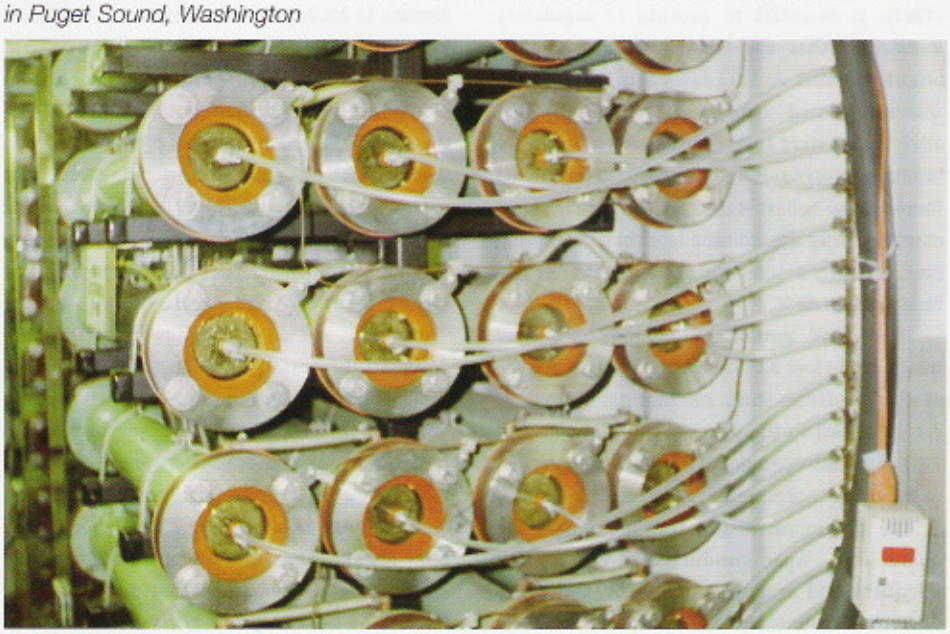
Time to exchange entrenched ballast water attitudes

Ballast water exchange is flawed, yet if shortsighted infighting goes unchecked, it will block technology development, environmental progress and international trade, argues Joel C Mandelman*

BP oil tanker Prince William Sound participated in ballast water technology trials in 2007, in Puget Sound, Washington



Nutech O3 equipment installed on board Tonsina

Aquatic nuisance species (ANS) are found in every sea going ship's ballast water. ANS cause billions of dollars annually in damage to ships' engines, power plants and municipal water treatment systems. They are an environmental and public health threat throughout the world. Zebra mussels, quagga mussels, Chinese mitten crabs, star fish and disease causing bacteria and viruses damage local water supplies and kill local fish and wildlife.

For decades, shipowners had only one 'solution' to the ANS problem: conducting deep ocean exchanges of ballast water several hundred miles offshore. Unfortunately, there are two things wrong with this solution: it does not work and it costs owners a lot of money.

Typically, deep ocean exchanges will only rid a ship of half of the ANS in its ballast tanks. The remaining ANS sink into the sediment at each tank bottom, only to reappear when the tank is refilled with 'clean' ballast water. Those ANS, especially bacteria and viruses, re-grow rapidly. If it takes a vessel two days to reach port after conducting an exchange, the ballast water may be 90 per cent as dirty as it was before the exchange; and there is no assurance that the exchanged water will not contain the same, or more dangerous new, invasive species than the discharged water.

Deep ocean exchanges are not free. Ten years ago, the US Coast Guard estimated that a single deep ocean exchange costs a shipowner between US$16,000 and US$80,000, depending on a vessel's size. With skyrocketing fuel prices and increased labour costs, those figures could easily be 50 per cent to 75 per cent higher today. Thus, a 125,000 dwt oil tanker, conducting one deep ocean exchange every two weeks, will waste approximately US$2 million a year – more than US$70 million over a ship's useful life – conducting ballast water exchanges.

Deep ocean exchanges are dangerous. In August 2006, a Japanese roro vehicle carrier, *Cougar Ace*, carrying 4,000 Mazdas to the US, took on a huge list and nearly capsized off the coast of Alaska, while conducting a deep ocean ballast water exchange. The economic loss exceeded US$100 million, including damage to the ship and the loss of all 4,000 vehicles.

Shipowners, therefore, have every incentive to install ballast water treatment technology on their own initiative. Soon, they will be required to do so.

The International Maritime Organization's Ballast Water & Sediments Treaty, when ratified, will require that all ships treat their ballast water and kill virtually all invasive species. The US Congress is considering legislation that would impose a treatment standard 100 times more stringent than IMO's standard. Some retrofitting will be required.

Today, safe and effective solutions to the ANS problem are available. One of the most extensively tested, proven, technologies for killing all invasive species is to inject ozone into the ballast water as it is taken on board. This treatment was developed by a US company, Nutech O3 Inc of Arlington, Virginia.

Ozone is made by taking ambient air and

stripping out the nitrogen cooling it, thereby concentrating the oxygen. It is then hit with a 10,000V charge of electricity which converts approximately 10 per cent of the concentrated oxygen into ozone. The ozone is immediately injected into the ballast water intake pipe as the water is taken on board. Ozone, as a gas, is never stored on the ship. Moreover, ozone, once it is injected into the ballast water, reverts to oxygen within five seconds.

The oxygen storage tank is located in a protected space, away from any danger of it being accidentally damaged. All the tank's pipes are welded and subjected to rigorous high pressure safety testing. Finally, each time that the system is shut down, the pipes are flushed with ambient air as an additional safety precaution.

The injection of the ozone kills a significant percentage of ANS, on contact. Ozone rapidly breaks down in sea water and reverts to oxygen. However, before reverting to oxygen, the ozone converts bromine, which is naturally found in sea water, into hypobromous acid. The hypobromous acid kills the remaining ANS within 24 to 48 hours. Most of that acid breaks down, and the treated ballast water may then be safely discharged in port.

The presence of trace quantities of bromine compounds, known as Total Residual Oxidant (TRO), is essential to proving to regulatory authorities that the ballast water has been properly treated. As long as there is TRO present, that means that there are no remaining ANS alive. If they were alive, they would consume the bromine compounds and there would be no TRO found in the ballast water. Testing for TRO is as easy as testing the chlorine level in a swimming pool. Virtually any member of a ship's crew can be trained to do it.

If a port authority demands proof of treatment before a vessel enters its port, readily available, off-the-shelf, monitoring technology can be added to the system. This can transmit TRO and other operational data, via the Internet, to regulatory agencies.

The development and testing of Nutech's technology was conducted by research scientists and engineers from the University of North Carolina, the University of California-Irvine, Iowa State University, the University of Washington and the University of Maryland. Initial testing, performed on the BP oil tanker *Tonsina*, in 2000, proved that ozone was effective in killing ANS.

Ballast water technologies undergo rigorous and extensive testing

Prior to testing its prototype system, in 2000, Nutech conducted tests at the La Que Center for Corrosion Technology in Wrightsville Beach, North Carolina. These demonstrated that ozonated ballast water does not increase the corrosion rate in a ballast water tank and may even slow it down, because killed bacteria do not secrete corrosion causing acids.

Nutech O3's technology was further successfully tested on the BP oil tanker, *Prince William Sound*, in 2007, in Puget Sound, Washington. A parallel series of at-sea and on-land tests, using similar ozone injection technology, were conducted on a barge that was specially designed and constructed for on land testing. This technology was then tested on board the Hyundai-owned *Kong Kong*, by NK Co, of Busan, Korea. NK Co's testing was successfully conducted in Korea, Singapore, Amsterdam and Hamburg; it was supervised by an independent institute pursuant to the relevant ISO standards. This technology is expected to receive final approval from IMO's Marine Environmental Protection Committee in October this year.

There is an ironic, Catch-22 aspect to the regulation of, and developing solutions for, the invasive species problem. The ANS threat could have ended several years ago but for political and bureaucratic infighting.

Most of the developers of treatment technologies are small companies, especially those in the US. Many of them have encountered serious difficulties in raising capital to speed bringing their equipment to the market. Prospective investors look at their technologies, learn about the worldwide scope of the ballast water treatment technology market and then announce, "This is wonderful. Come back and see us when someone establishes a treatment standard." This has significantly slowed down the development of effective treatment technologies.

Simultaneously, IMO member countries, including the US, have been slow to ratify the Ballast Water & Sediments Treaty because, they claimed, there were no treatment technologies on the market! The US Congress, which has been considering its own ballast water legislation since 2000, has also used this excuse for not enacting legislation containing a treatment standard. US regulatory agencies similarly use this reason as their rationalisation for not issuing treatment standards. A related concern is that the US Congress will yield to special interest group pressures, which will result in the promulgation of scientifically useless treatment standards.

Beyond this, some environmental groups are blocking passage of legislation in the US because they want each of the 50 states to be allowed to have their own, conflicting, treatment requirements. Allowing that to happen would paralyse international trade with the USA. TST

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NRC counsels treaty ratification

The US should immediately adopt international ballast water treatment standards to prevent ocean-going vessels from hauling more foreign species into the Great Lakes, according to a report published by its National Research Council. "The only way to eliminate all further aquatic invasive species introductions into the Great Lakes by vessels transiting the St Lawrence Seaway would be to close the waterway to all vessel traffic," the NRC said in its report. "Such action, which appears unlikely from a political perspective, would eliminate a trade route into and out of the Great Lakes and would not, therefore, enhance the region's potential for global trade."

The National Research Council's stated mission is to "improve government decision making and public policy, increase public education and understanding, and promote the acquisition and dissemination of knowledge in matters involving science, engineering, technology and health."

Alfa Laval secures DNV approval

Alfa Laval's chemical-free system for ballast water treatment, PureBallast, has received full type approval from DNV, on behalf of Norwegian authorities. The certification, issued on 27 June, confirms that PureBallast complies in full with pending ballast water treatment legislation from the International Maritime Organization (IMO).

The PureBallast system has been purchased for installation aboard more then 25 vessels since its launch in 2006. Having received full ballast water type approval, it is the first without chemical treatment processes to be certified IMO-compliant.