NORTH SEA BALLAST WATER

European Union The European Regional Development Fund

The Interreg IVB North Sea Region Programme

Investing in the future by working together for a sustainable and competitive region

PROCEEDING FROM THE NSBWO CONFERENCE 'FROM CONCEPT TO REALITY'

Januari 2014

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'FROM CONCEPT TO REALITY'

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Organisation: NIOZ (Royal Netherlands Institute for Sea Research) and the ProSea Foundation – both part of the North Sea Ballast Water Opportunity project.

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1 ABBREVIATIONS

BW – ballast water

BWM – ballast water management

BWTS – ballast water treatment system

CME – Compliance monitoring and enforcement

GESAMP – Group of Experts on the Scientific Aspects of Marine Environmental Protection

IMO – International maritime organisation

MEPC – marine environment protection committee

PSC – port state control

USCG – United States Coast Guard

WP – work package

2 INTRODUCTION

Ballast water management is one of the biggest environmental challenges facing the shipping industry today. With the upcoming ratification of the IMO Ballast Water Management Convention (another 5% of the world's tonnage is needed), the 'Final Rule' on Ballast Water of the US Coast Guard and the new Vessel General permit 2013 of the US-EPA, all ships must treat their ballast water in the near future, so that the risk of introducing invasive species is minimized.

The past five years, policy makers, shipping companies, ports, scientists, and other stakeholders have cooperated in the North Sea Ballast Water Opportunity project (NSBWO) to facilitate implementation of the new ballast water regulations in the North Sea region. The proceedings give an overview of the subjects that were addressed during the NSBWO conference 'Ballast Water Management: from concept to reality' at the Europort Maritime Exhibition in Rotterdam on 6 and 7 November 2013.

The building blocks for the conference were brief presentations summarizing some main results of the NSBWO project, a workshop where the participants were asked to share their main concerns, 'cafe meetings' where a wide range of international experts, the majority of whom are part of the NSBWO project, addressed the main concerns, including those about 'enforcement and control', 'US regulations', and 'the retrofit challenge', and finally a presentation showing a ship owner's perspective followed by a general discussion.

3 PRESENTATIONS

3.1 INTRODUCTION

By Jan Boon – NIOZ
NSBWO work package 1 (Organisation, coordination and management)

NIOZ Royal Netherlands Institute for Sea Research is the coordinator of the North Sea Ballast Water Opportunity project.

Introduction of the project

The North Sea is an intensively used and biologically highly productive area. It is also one of the global hotspots of marine invasive species. Even though the North Sea is such an intensively used area, and one might think the North Sea is already 'saturated' with invasive species, recent studies still show new imports. The North Sea Ballast Water Opportunity Project originated from the need to prepare the North Sea region for implementation of the IMO Ballast Water Management Convention (BWMC) of 2004.

The main goals of this project are:

- Rapid ratification of the BWMC by the countries bordering the North Sea;
- Regional cohesion (coherent North Sea BWM policies);
- To refine test procedures and methods using during land-based and ship-board tests for type approval;
- To develop rapid test methods as compliance monitoring & enforcement tools;
- To utilize the project for developments of new European innovative products;
- To disseminate the knowledge gained to professional stakeholders and improve transparency of test procedures.

40 partners participate in the project, and contain governmental representatives, marine and maritime research institutes, ports, a national shipping organisation, a classification society, NGO's, manufacturers of BWTS, and developers of equipment for compliance monitoring. The project will end on 30 June 2014.

Introduction of the problem of invasive species

During the uptake of ballast water, different planktonic organisms living in the sea water are taken up too. Along with the ship, such organisms can be transported to different environments where they are not present originally. In the new surroundings, they are called alien species or invasive species. Invasive species are not harmful by definition. However, when a newly introduced species is present in sufficiently large numbers, does not have natural enemies in the new environment and when environmental conditions (salinity, temperature) are favourable for their growth, an introduced species

can develop into an invasive species and may become a risk for human health, economy, and the environment.

Marine organisms present in ballast water come in all sorts of sizes and concentrations: viruses as small as 0.1 µm (millions per millilitre), bacteria of 0.1−1.0 µm (a hundred thousands per millilitre), phytoplankton (small algae) of 2−100 µm, and zooplankton larger than 10 µm. The IMO regulation D2 discharge standard sets maximum allowable limits for organisms in the size range of 10−50 µm (mostly phytoplankton), organisms bigger than 50 µm (mostly zooplankton), and three different kinds of bacteria posing a risk for human health. Besides these bacteria, the IMO standard does not take into account any organisms smaller than 10 µm, among which are several species of toxic algae.

The main sources of invasive species in the marine environment are shipping (biofouling and ballast water) and aquaculture. The risk of a bioinvasion by shipping depends on several factors, such as the intensity of shipping between regions, the amount of ballast water taken up and discharged, the (dis)similarity of the donor and recipient location of the BW (in terms of temperature and salinity), and the voyage distance (there are indications that the highest risk may be posed by voyages of intermediate distance: Seebens et al. 2013[1]). Model simulations revealed that already moderate efforts of BW treatment can already yield substantial results: the overall invasion probability was reduced by 82% when ballast water was assumed to be treated with an efficiency of 50% at every port. Most of the invasive species already present in the North Sea originate from the Atlantic coast of the USA (Seebens et al. 2013).

In the course of the project, NSBWO has developed and maintained many contacts with important organisations and regulatory bodies in Europe (EMSA, HELCOM, OSPAR), in the USA (US Coast Guard) and on a global scale (e.g. ICES, IMO MEPC and PPR, GloBal TestNet) in the field of ballast water management. NSBWO partners directly participated in many of these bodies, which has led to a very efficient cross-flow of knowledge and opinions.

3.2 THE ENVIRONMENTAL PERSPECTIVE

By Marieke Verweij – ProSea, marine education
NSBWO work package 6 (Dissemination)

ProSea is an educational foundation that gives trainings about sustainability and marine awareness to marine professionals. Within the scope of the NSBWO project, ProSea has developed a workshop day for ship owners tackling their main issues concerning the ballast water challenge. During the NSBWO project, ProSea has executed this workshop in the Netherlands (Schiphol) and in Germany (Hamburg and Leer).

[1] Seebens H, Gastner MT, Blasius B. 2013. The risk of marine bioinvasion caused by global shipping. Ecology letters 16: 782–790

Invasive species: ecological roulette

Almost every marine species has a planktonic life stage that can be transported by ballast water. This means that virtually any species can be transported in ballast water tanks, also species of which the adults are too large to be taken on in ballast water. To understand why an invasive species can become a problem, it is important to understand that everything in the sea is connected. Take for instance a food web in the North Sea: tiny algae, called phytoplankton, form the basis and are eaten by slightly bigger animals, which are eaten by small fish and bottom fauna, which are eaten by bigger fish and crabs, which are eaten by top predators such as seals. This example is part of a very simplified food web in the North Sea. In reality such food webs are much more complicated, with many more cross-links between organisms. Therefore it is very difficult to predict what will happen when an alien species is introduced and takes on a role in such an intricate and complex system. It can be seen as 'ecological roulette': once a species has invaded, it may have a cascade of effects on other species in the same food web and ecosystem, and the effect may be devastating, but may also be rather harmless.

Consequences of an invasion

An alien species can compete with native species for food or space. Invasive species may change the structure of food webs, leading to lower biodiversity and with that a less resilient ecosystem. The zebra mussel and comb jelly are case-study species showing what ecological and economic effects can be inflicted by invasive species.

The zebra mussel is native to the Black and Caspian Seas and has been introduced in the US Great Lakes by ballast water and hull fouling. In the Great Lakes the shellfish outcompetes other algae feeders, suffocates other molluscs, smothers underwater substrates, and clogs man-made underwater structures such as water intakes for power plants and industrial facilities. In 10 years´ time, the mussel has cost the USA between 750 million and 1 billion euros. To date the zebra mussel is one of the most aggressive freshwater invaders worldwide.

The comb jelly, native to the Atlantic coast of America was introduced to Europe though ballast water. The comb jelly seriously damaged the ecosystem and fishing communities of the Black and Caspian Seas. The jellyfish is a ferocious zooplankton eater and with that it competes aggressively with the local anchovy (a small fish species) for their main food source. Since the introduction of the comb jelly in the Black and Caspian Sea, the anchovy landings have decreased drastically, costing the local fishing community 500 million euros a year.

Global economic losses of marine invasive species are estimated to come down to 7 billion euros a year. Because ballast water can also transport species such as cholera and toxic algae, invaders may also have consequences for human health. For instance, red tides existing of toxic algae have increased the occurrence of paralytic shellfish poisoning, which can be deadly for humans eating contaminated shellfish.

Not too late to tackle the problem

Alien species have been invading new areas for centuries, mainly as a result of ship traffic, aquaculture, and canals. That does not mean that we are too late to tackle the problem, because the introduction of

new species is still ongoing due to the increased global movement of people and goods. According to NOAA (National Oceanic and Atmospheric Administration), a marine species invades a new environment somewhere in the world on a weekly to daily basis. Because once an alien species has established itself in a new environment it is almost impossible to get rid of; prevention is the best way to tackle the problem.

Shipping is considered to be the most important source of marine invasive species across the world. In sea-going ships, species travel along in ballast water tanks or attach themselves to ship hulls. Of the invasive species introduced by shipping and considered by researchers in 2008 (study by Molnar and others), 39% were introduced by hull-fouling, 31% via ballast water and the remainder via both. This means that besides ballast water, biofouling is an important pathway of shipping related introductions of species. The expectation is that biofouling will get more attention in the shipping world the coming years.

3.3 ENVIRONMENTAL RISK

By Annuka Pekkarinen – World Maritime University (WMU)
NSBWO work package 5 (Strategies)

The WMU is an initiative of the International Maritime Organisation (IMO) and was founded in 1983. WMU topics include maritime transportation, safety, policy and administration, security, management, and environmental protection.

North Sea Aliens Species Database

For the NSBWO project the WMU developed a database for alien species (www.norsas.eu). The website gives current information on the status of alien species in the North Sea region. So far, 75 species have been uploaded, 46 species will be uploaded very soon (datasheets are finished) and 56 species remain to be examined and uploaded. The Norsas website can aid in the early detection of species and it can be used as an identification tool. The WMU aspires to combine the Norsas database with the Global Invasive Species database.

Ballast water risk management

WMU, DHI, and the University of Aarhus have developed a prototype Decision Support Tool based on a hydrodynamic model of the North Sea. The model divides the North Sea into smaller areas and concentrates on the ecological connectivity of these areas. The model calculates the dispersal probability of organisms from ballast water release into and between different North Sea areas.

The WMU also assesses the environmental impacts of shipping in the Arctic (with a focus on the introduction of invasive species and pathogens through biofouling) in a project funded by the Total Foundation. The project aims to determine whether ships calling at two selected ports in the Barents Sea present a risk of introductions. Sampling is carried out in Greenland, Murmansk, and Norway.

The WMU also aims to start a new project concerning port baseline inventories in the Baltic Sea. The Swedish Institute funds the start-up phase of the project. Standardized port baseline inventories were developed to determine similarities between the ecosystems and species composition in ports. This is baseline information for granting ballast water exemptions.

Compliance monitoring and enforcement course

For the ballast water management convention to be successful, clear and thorough methods of enforcement are crucial. Many challenges in compliance monitoring and enforcement remain though. Firstly concerning sampling (How? Where? When? Frequency? Representativeness of sample?) and secondly concerning enforcement (ballast water samples as basis for enforcement actions - evidentiary requirements). In accordance with the project the WMU has developed courses for Compliance Monitoring & Enforcement. This 2-day course has been developed for professionals in Flag and Port state control and consists of five modules. This course has been successfully executed at several locations since 2011 (latest course was organised at the WMU in October 2013).

The WMU has also produced a children's book explaining the problem of ballast water and invasive species to increase awareness of the general public.

3.4 THE POLICY PERSPECTIVE

By Stefan Kacan – BSH
NSBWO work package 2 (Coherence, harmonisation and transparency)

The German Federal Maritime and Hydrographic Agency (BSH: Bundesamt für Seeschifffahrt und Hydrographie) is an agency within the remit of the Federal Ministry of Transport, Building and Urban Development. The agency covers a wide range of tasks, including environmental protection in maritime transport (hence also ballast water and invasive species).

Current Status of BWMC

On June 2013, Germany ratified the BWMC as the 37th flag state, adding 1.26% gross tonnage of the world´s merchant fleet. The current total gross tonnage (after the Swiss ratification on 27 September 2013) is 30.38%. So in order to achieve the 35% gross tonnage, further ratifications are required. The translation of the BWMC into German national law has successfully been realized by passing the ´Ballast Water Act´.

Current status of BWTS type approvals

By May 2013 worldwide 33 BWTS were type-approved. Several other systems are currently in the approval process. Of the 33 systems with Type Approval, 22 use active substances (G9 type approval) and 11 do not (G8 type approval). Out of these 33 approvals, six have been granted by Germay (Hamann, RWO, Mahle, STDN, Ecochlor, and GEA Westfalia).

Cooperation in the Approval Process

BSH guides the type approval process, and uses the expertise of other German authorities including the Federal Environment Agency (UBA), the Ship's Safety Division (BG Verkehr) and the Federal Institute for Risk Assessment (BfR). BSH also tries to transfer the knowledge gained within the project to the international arena. So, in the NSBWO-project, we cooperate closely with other national Authorities in the North Sea Area, including the Swedish Transport Agency, the Danish Ministry of the Environment, the

Norwegian Maritime Directorate, the Dutch Ministry of Infrastructure and Environment, and the Flemish Government.

The following project results are examples of results that are fully, partially, or soon-to-be adopted in international policy.

Granting of exemptions

The condition for an exemption is, that there is no risk for the environment, human health, property or resources. The BWMC allows the granting of Exemptions under the provisions of Regulation A-4 for a ship or ships on a voyage or voyages between specified ports or locations or to a ship that operates exclusively between specified ports or locations. Risk of invasions must be determined by a risk assessment (G7 guidelines specified by the IMO).

Primarily, the Dutch Ministry of Transport chaired a correspondence group on granting exemptions from BW-treatment. BSH was involved in in the process in finding common rules for granting these exemptions. The BSH has developed a risk assessment scheme to find out if there is a high or low risk for special voyages between two ports. Basic criteria for the risk assessment are:

Salinity conditions in the ports (habitats)

Occurrence and the number of target species

Ecological potency of the target species with respect to salinity

Following the scheme and answering the questions with yes or no, finally, you will get an idea of the risk of spreading of non-indigenous species between the two ports in question.

Based on this risk assessment, an online tool is under development by Brockmann Consult. The tool evaluates the data, indicating low, medium and high risk for a voyage. However, the decision to grant or not to grant an exemption rests with the coastal state.

On initiative of Germany, HELCOM and OSPAR Commissions have been working together on BWMC Exemptions. A couple of weeks ago (3 October 2013), the Joint HELCOM/OSPAR Guidelines on the granting of exemptions under BWMC, Regulation A-4 were adopted. They will ensure that exemptions are granted in a consistent manner once the BWMC enters into force.

Ballast water sampling and analysis

Suitable and commonly accepted methods for ballast water sampling and analysis are crucial in successful ballast water management. The BSH conducted a competition to identify promising technologies for efficient controls on board ships to assess the compliance with the regulations of the BWC. The aims of the project (which is still going on) are to develop:

- quick, representative on board sampling systems
- rapid, analytical on board method to indicatively define "gross non-compliance"

Participants were invited to submit a method, product or procedure by the end of November 2011. The first, second and third ranked participants received an award of 10.000 Euro (Nick Welschmeyer, SGS, and Cees van Slooten (NIOZ)). Also, the BSH awarded a substantial research contract on sampling and analysis to SGS for primarily the sampling part and Nick Welschmeyer for the part of rapid analysis.

The methods available are quick and easy to handle after a short training which will be given to the responsible port state control officers. The method depends on the organism group that shall be tested. For organisms sized between 10 and 50 micrometers and larger than 50 micrometers, the methods available are FDA (Fluorescence-diacetate Fluorometry), PAM (Pulse Amplitude Modulation Fluorometry) and ATP (Adenosin-triphosphate Fluorometry). For bacteria the FISH-method (Fluorescence-in-situ-Hybridisation) and ATP can be used.

Emission scenario document (ESD)

Two-thirds of BWTS use active substances and a secondary risk to the environment could appear by these substances and their by-products. So, the environmental risk assessment is an essential requirement in the approval process. A basic part of this risk assessment is an emission scenario document. An ESD is used for modelling the final environmental concentration of chemicals taking into consideration e.g. the dilution and the fate of the substances. It is a general not a site specific model. The Federal Environment Agency adapted the existing ESD for Antifouling-Substances to the special needs of treated ballast water, jointly with Deltares, the University of Amsterdam and the Hamburg Technical University. This ESD has already become part of the GESAMP-methodology.

Human Exposure Scenario (HES)

The Federal Institute for Risk assessment (BfR) identified the need for a better human exposure assessment for ballast water. A more comprehensive approach based on the type of BWTS, the quality of the treated water and the toxicity of compounds discharged into the environment was proposed. This requires knowledge of exposure situations. BfR provided a comprehensive listing of occupational exposure (e.g. oral intake via contaminated seafood) and non-occupational exposure (e.g. oral and dermal intake or inhalation during sea bathing) settings and quantification models for an exposure assessment.

Manual for Approval of BWTS

In the final phase of this project, a Manual for Approval of Ballast Water Management Systems will be compiled. This manual can be seen as a compendium of the work that was done by the policy work package in the NSBWO project and may be used as a comprehensive guideline for all parties that are involved in approving BWTS.

A technical and enforcement perspective

By Louis Peperzak – NIOZ and Stephan Gollasch – Goconcult
NSBWO work package 3 & 4 (Testing of Ballast Water Treatment Systems & Compliance enforcement technology)

NIOZ Royal Netherlands Institute for Sea Research, coordinator of the NSBWO project, was also responsible for work package 3 (WP3: testing of ballast water systems). GoConsult was responsible for compliance enforcement technology and on board tests of organism detection technologies to assess compliance with the D-2 Standard of the BWM Convention (WP4).

Ballast Water Performance Standard

Ships meeting the ballast water performance standard of the BWMC (the IMO D-2 standard for discharged ballast water) must discharge:

<10 viable organisms per cubic metre greater than or equal to 50 micrometres in minimum dimension;

<10 viable organisms per millilitre less than 50 micrometres in minimum dimension and greater than or equal to 10 micrometres in minimum dimension;

<the following concentrations of indicator microbes (human health related):

Toxicogenic *Vibrio cholerae* with less than 1 Colony Forming Unit (cfu) per 100 ml or less than 1 cfu per 1 gram (wet weight) of zooplankton samples;

- *Escherichia coli* less than 250 cfu per 100 millilitres;
- *Intestinal Enterococci* less than 100 cfu per 100 millilitres.

The main questions for WP 3 and 4 were: can BWTS be tested

on land and on-board for IMO Type Approval; and

on-board for compliance monitoring & enforcement?

The answer to these questions is: Yes!

Technical challenges

There are several technical challenges for testing whether a BWTS meets the D2 standard:

- Finding <10 viable organisms per cubic meter of water
- Testing all organisms mentioned in the D2 standard that have large size differences, relative to each other
- How to measure minimal dimension of plankton organisms
- How to identify viable organisms, and what do we consider to be viable
- During the NSBWO project, all these challenges have been dealt with.
- With plankton nets, we are able to find 1 organism per cubic meter of water.
- By using microscopes and flow cytometers we are able to count organism concentrations of all sizes in treated water.
- We have reached agreements on how to measure minimal dimension of plankton cells

- Viable cells are found by staining techniques (dyes) for zooplankton
- Pulse Amplitude Modulated fluorometry (PAM) is used to identify viable phytoplankton cells
- counting numbers of colony forming units for bacteria is permitted with selective growth media.

All these techniques have been put into practice by NIOZ (land-based testing) and GoConsult (ship-board testing).

Deliverables of WP3 and WP4

As a result of land-based testing at NIOZ, 10 BWTS have been added to a TA-list.

NIOZ is comparing 34 manufacturers by making an inventory of CAPEX, OPEX, footprint, and power consumption (at 1000 m3/h). We received 6 responses in 1 week and expect many more, since it is an ongoing project. This comparison may give ship owners a first indication of the relative differences between the different BWTS techniques and manufacturers.

Comparing organism viability/regrowth after treatment. As part of a scientific study, UV- and Active Substances treatment systems were compared on the basis of organism regrowth in deballasted water.

We have produced several scientific reports by which we transfer knowledge for detection of organisms in ballast water.

Guidance on Ballast Water Management related Risk Assessment for Exemptions from ballast water management requirements (June 2010)

Quick methods for monitoring ballast water on board have been developed. These are hand-held devices that provide a gross non-compliance check with the D-2 Standard within minutes.

Outstanding questions

There are still some outstanding questions:

Standardization of component testing, before or after Type Approval (TA). After TA newer and potentially better filters cannot replace the filter that was part of the system as it was tested for approval. Standardization of filter tests may ease this stringent rule.

Harmonisation of IMO and ETV protocols. Manufacturers now have to undergo two TA tests, for IMO and for the USCG. Harmonisation of the test protocols could lead to one TA test for both organisations.

CME methods evaluation, harmonization, standardization. Different Compliance monitoring and enforcement (CME) techniques are being developed. Are they comparable in measuring non-compliant ballast water?

World-wide BWTS performance. B-box project: following on joint experience of WP3 and WP4, NIOZ now provides a self-monitoring service to the BWTS manufacturers and the shipping industry to have ballast water samples analysed at NIOZ after they have been sent from the ship in a specially designed cool

box. The B-box does not include sampling equipment, but was especially designed to ensure minimal impact of samples during transport. More info on *www.ballastwaterbox.nl*.

4 MAIN CONCERNS WORKSHOP

In preparation of the café meeting sessions (Q&A session with experts), all conference attendees were asked to note their main concerns, questions, and/or frustrations about ballast water related topics on white sheets posted on the walls. Below, the results are given:

Exemptions

Who may get it? Who will issue it?

How about unmanned tow of ballasted pontoons?

Special ships

What are the options for heavy transport ships with large volumes of ballast water being transferred with a high pump ratio?

How to choose and design a treatment system not using the intake/discharge line (flushing method with reduced capacity in comparison to pump)

Retrofitting

How to deal with peak in demand?

How to deal with untreated sediments?

Changes to be made in the existing ballast water scheme?

Dirty ballasting to face peak value?

US regulations

Will US develop monitoring (BW treatment) equipment certification test protocols?

Are there publicly available criteria for ship owners to justify/negotiate exemption/delay of having to be compliant for a specific type of ship?

What is the status of the shipboard test protocol? Will the test methods be different than the ones in the land based protocol?

Great lakes: do US or Canadian rules apply?

How stable is US regulation and what does it mean for BWT suppliers (in terms of market)?

Treatment systems approval and installations – class perspective

Problem with untreated sediments in tanks

Can land and ship based testing be conducted parallel?

What's the minimum test duration?

Document to be submitted. Until when? And is there any template?

Who takes over the installation costs for ship based testing? What is the trend?

Role of ports

If ship's treatment system fails, what will happen?

Compliance, monitoring and enforcement

What should be monitored? Where and how often?

When is a sample representative of the discharge and the performance of the BWTS (sample size and location)?

Will there be a deadline for the trial phase of the sampling guidelines adopted at MEPC 65?

Sampling done by shipboard personal? Certifications? Sample storage of shipping time allowed?

How is plankton > 50 micrometres (zooplankton) assessed? By commercial labs? How about non-planktonic organisms in sediment?

Transparency

Is there an "institution" that checks if information is transparent?

What efforts are in progress that will allow a customer to review data with sufficient quality to develop reasonable confidence that a BWTS will reliably meet the standard for their specific application worldwide?

Will the results from PSC checks during the test phase be publicly available?

Other issues

How to deal with sediments and semi-sediments?

Is hull fouling given the same priority as ballast water when it comes to regulating its effect?

How to keep systems running properly (maintenance, operation) on board of ships with low educated crew?

Can wastewater permeate be used as ballast water?

Ballast capacity too large for intake/discharge treatment. How to design and implement 'flushing' method using the vessels stripping system?

What documents are to be submitted for Type Approval? Until when? Is there a template?

5 CAFE MEETINGS

The café meeting experts tried to address as many of the above questions and concerns as possible. Below is an overview of the main topics discussed at the eight cafe meetings.

5.1 EXEMPTIONS

Expert: Henrik Ramstedt – Swedish Transport Agency

Who can get an exemption?
Exemptions can be issued to a specific ship on a specific route. Exemptions will most likely be of interest to ships that sail to few locations on fixed routes, like e.g. ferries. Ships that sail on domestic routes are excluded from the convention so they do not have to apply for an exemption, unless it is required by that specific country. Exemptions can only be issued based on a risk assessment, which means that the species living in the water in the different ports will be compared. If the ports are very similar and contain the same species, a ship might get an exemption. A wide range of species will be studied in the risk assessment, including target species that are already known as invasive. The presence of one species might be enough to have a high risk.

Are the guidelines for exemptions accepted by the IMO?
The guidelines are a regional agreement on a harmonized procedure according to Article 13 in the IMO Ballast Water Management Convention. They are formulated by the joint HELCOM/OSPAR task group and provide a common approach for exemptions issued in the North Sea and Baltic Sea area.

Who will issue the exemptions?
Coastal states (not the flag states) will issue the exemptions. They must be notified to the IMO.

Who should do the risk assessment?
The ship owner has to ensure collection of the data on which species are present in the ports that he wants the exemption for.

Who should pay and how high are the costs?
The ship owner should pay for the sampling. The costs for sampling in two ports are estimated to be about 50,000 Euros. Shippers could cooperate or create a burden sharing mechanism.

How long will it take to get an exemption?
At least six months. Samples need to be collected in early summer and in late summer. Afterwards an expert should analyze the data. On top of that, administration needs time for decision making.

How long will the exemption be valid?
Exemptions can be valid for a period up to maximum five years. However, exemptions are uncertain, because the situation can change over time, for example if new species are introduced in the area, it is possible that an exemption is withdrawn before the end of the five years.

Where should the sampling take place?

There should be at least three sampling points, close to where the ship is in the port. It is up to the authority to say where the samples should be taken exactly and how many would be enough. Coastal states can decide to take other factors than the sampling into account in the assessing the risk, like a nature area nearby. This should be communicated to the ship owner in an early stadium of the application.

5.2 SPECIAL SHIPS

Expert: Niels van de Minkelis – Royal Association of Netherlands Ship Owners

Are there options for heavy transport ships with large volumes of ballast water being transferred with a high pump ratio?

IMO has reviewed the availability of BW treatment technologies to achieve the D2 performance standard. MEPC 61 invited Member Governments and observers to propose practical solutions to the challenges identified in relation to some special ship types, in particular seagoing unmanned barges, semi-submersibles and heavy lift crane vessels. A practical solution was proposed for some of these special types of ships based on the treatment of the water after it has been pumped into the tank. Treatment by internal circulation is considered to be an appropriate solution for semi-submersible ships and possibly for other types of ships that require transferring high quantities of ballast water with a high pump ratio. Semi-submersible ships take up and discharge a large quantity of ballast water at the same location in a short period of time. A relatively small quantity of ballast water remains on board during the voyage for stress, stability and trim purposes. It is therefore proposed to solely treat the remaining ballast water on board by internal circulation. Contrary to most in-line ballast water management systems, which treat ballast water during the uptake and/or discharge, the proposed treatment by internal circulation would treat the water only after it has been pumped into the tank. Treatment is carried out by circulation of the ballast water within the ship during the voyage by a separate pumping system while applying electro-chlorination technology. The existing ballast water lines could be used as return lines to the ballast tanks and will therefore also be flushed with treated ballast water.

Is there a solution for small vessels that only carry a small volume of ballast water (e.g. survey vessels and drilling vessels)?

Implementation of the Convention is likely to prove particularly difficult for smaller ships, such as offshore supply vessels, tugs, workboats and fishing vessels. These ships occasionally take on board or discharge small volumes of ballast water and are required to comply with the Convention. Due to the limited availability of physical space to either retrofit or install a ballast water management system on board, compliance with the D2 standard will be challenging. Use of drinking water taken from a public water supply as ballast water could provide a possible solution for small ships. It is not expected that drinking water will be used in large quantities for ballast water purposes, because of the relatively high costs. Furthermore, the availability of drinking water may be limited during operations when ballasting is needed. The IMO MEPC considered the use of drinking water as an additional ballast water management option, proposing an application procedure for approval of the use of Active Substances in drinking water. The Committee, in agreeing that this complex matter requires thorough consideration, noted that the decision to supply drinking water to ships remains the authority of the port State.

How can unmanned seagoing barges comply with the Ballast Water Convention?
For unmanned barges, a solution is yet to be identified.

When a ship operates all around the world and has enormous ballast water holding capacity, what does the convention say?
The Convention and its provisions also apply on ships with a large ballast water holding capacity.

How about dredgers that work in the same location?
The BWM Convention includes provisions for cases where vessels do not need to manage their ballast water (i.e., Regulation A-3 Exceptions and Regulation A-4 Exemptions). Exceptions are identified for specific cases including (1) BW uptake or discharge is needed for ensuring the safety of a ship in emergency situations, (2) accidental discharge results from damage to a ship or its equipment, (3) uptake or discharge of BW is used to avoid or minimize pollution incidents, (4) uptake and discharge of the same BW is conducted on the high seas, or (5) uptake and discharge occurs at the same location, provided no mixing occurs with other locations. ''High seas'' and ''same location'' exceptions may apply permanently if this is a regular vessel operation. The application of an exemption or a permanent exception means that a vessel is not required to install a BWTS. However, the BWM Convention is not specific in defining ''same location,'' thus the concept is subject to different interpretations. This introduces difficulties for a uniform implementation of the BWM Convention.
As far as hopper dredgers are concerned: According to the BWMC, "Ballast Water" means water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship. Water in the hopper is considered as outboard water, i.e. the water is not taken aboard. Furthermore, the water is not used to control trim, list, draught or stresses of the ship. The IMO MEPC has agreed that water present in the hopper area is not considered ballast water.

5.3 TRANSPARENCY

Expert: Cato ten Hallers – CaTO Marine Ecosystems

Is there an institution or agency that checks if information is transparent?
No. But there are international frameworks for safeguarding transparency. In Europe there is the UN-ECE Aarhus Convention (1998) and in the US there is the Public Information Act. These instruments regulate public right. Each party has to ensure that public authorities, in response to a request for environmental information, make such information available to the public.
Confidence is very important for enforcing the Ballast water Convention. Transparency can create confidence. Transparency should be on all levels:

On national level, safeguard transparency on process, science and technology underlying certification and Port State Control. This is a role for governments, scientist and manufactures.

In IMO by voicing the Call for full Transparency and working together to develop a robust transparency system

Which information shall I give to my customer as a supplier of Ballast water treatment systems?
There is no set list of criteria of which information a supplier has to give to their customer and other

relevant parties, other than the listed non-confidential issues in the methodology for approval under guideline G9 (on ballast-water management systems that make use of active substances). A ship's operator (captain) needs an operational tool to ensure that the installed BWM system works properly; a log display similar to that used for oil-water separators may be appropriate. Parameters could include how many chemicals are added or generated, is the water flow constant, are the UV lamps are clean, salinity concentrations (important for electrolysis)? Transparency is also needed on guidance on how to act if an unforeseen problem arises when operating a BWM system. There is some progress in transparency towards ship owners. Ship owners themselves should also be transparent on the knowledge gained when operating a BWMS on-board ship.

Are the results from the Port State Control checks during the test phase going to be published and to what extend?

The results and experiences of Port State Control actions gained in testing compliance during the phase where the BWM Convention is not in force, might lead to adjustments in the Ballast Water Convention. The knowledge in 2004, when the Convention was adopted, was limited compared to the present knowledge and understanding. When the Convention is in force, it can be amended according to new knowledge. In the decision process scientific rationales can sometimes be overruled by policy considerations; once the Convention is in force, it may be amended.

Is there a plan for independent testing?

There are at present several options for independent testing. One can find such information in the Lloyds Register yearly ballast water management updates. One also needs to be aware that not all parameters are standardised.

5.4 ROLE OF PORTS AND PORT BASED BALLAST WATER TREATMENT FACILITY

Experts: Geert-Jan Reinders - Groningen Seaports, and Tjitse Lupgens – Damen shipyards

Why did Groningen Seaports engage in the project of enabling a port based ballast water treatment facility with Damen shipyards?

The ballast water convention puts all responsibility on ship owners. Ports could feel the moral obligation to play a role in the solution too. Groningen Seaports recognizes this and wants to help shipping in becoming more sustainable. Groningen Seaports realises that port operations can have an effect on the surrounding especially in an area as the Wadden Sea (World Heritage site), where Groningen Seaports is located.

Is it compulsory for a port to have a mobile treatment plant?

No, it is a voluntary service. The IMO only has guidelines for reception of sediments from the ballast water tanks for ports.

Is this treatment facility reality?

Yes, it will be available in Groningen Seaports from 2015 onwards. The facility is UV based and has a filter of 10 microns.

Can this port based treatment facility work in other ports?
Yes, the harbour based treatment facility could be a boat which would be flexible to go to the places where it is needed. We have the idea to containerise it for small ports.

What kind of ships would use such a port based treatment system?
The port based plant can be a solution when a ballast water treatment plant on board a ship fails or when there is no treatment plant on board (yet, or at all: there are too many ships to retrofit in time and certain ships may be too old to install a treatment plant). The port-based plant can reduce costs for ships that visit a couple of ports regularly (about 10 visits per port a year). The current reception facility can handle flow speeds of about 600-700 m^3/hour, making it suitable for smaller ships up to 8000 tons DW with roughly 2000-3000 tons of ballast water.

Do small ballast water ships actually need a ballast water treatments?
That depends on the biological zones. Exemptions are only granted if you can prove that the water is the same in your intake and discharge location. This almost never the case. There was a study showing that when shipping between Hamburg and Antwerp, Antwerp harbour had 11 animals which are unwanted in Hamburg.

What does this barge cost?
According to our business case, the return on investment is between 4 and 5 years.

5.5 CLASS PERSPECTIVE (SYSTEM APPROVALS AND INSTALLATION)

Expert: Ubong Okon – Lloyd's Register (LR)

What kind of approvals do BWTS have to have in total?
All BWTS are to be tested for compliance with the performance standard of IMO resolution MEPC.174(58) generally called G8 type approval. On top of that, BWTS that use active substances such as chemical disinfectants are to undergo basic and final approvals in accordance with IMO resolution MEPC.169(57) - G9 approvals. A final type approval certification will be issued following satisfactory compliance with the D2 discharge standard. It is generally referred to using terms such as ´statutory type approval´, ´IMO BWTS type approval´, or ´G8 type approval´. Such type approval may either be issued by the National Administration, or by a Recognised Organisation, for example Lloyd's Register, on behalf of the National Administration.

What exactly is class type approval?
Prior to installation of the BWTS on board a ship, the BWTS must be assessed by the Classification Society of the ship to ensure safety and that the components of the BWTS comply with the Class's Rules. An example of class type approval is the optional Lloyd's Register Type Approval (TA) but as a minimum the BWTS must be design appraised and issued with a marine design appraisal document. Upon satisfactory completion of LR type approval, the BWTS will be added to the list of LR's approved products and the BWTS manufacturer can use the Lloyd's Register Type Approval mark on promotional literature as a marketing tool for the product.

During installation of the BWTS on a ship by ship basis, the safe integration of the BWTS piping and electrical system with other ship systems are considered in accordance with the Classification Society's

Rules and taking into consideration the installation location. A typical outcome is a design appraisal document issued for the specific ship installation indicating that the integration of the BWTS on the specific ship complies with the Classification Society's Rules.

There is no certainty that a type approved BWTS will work under all operational circumstances! And there are many type approved systems that do not have detailed information on the TA process. How does class deal with this?

- It is important to analyze under what environmental conditions one sails and then choose the right BWTS taking into consideration the vessel type and characteristics, trading pattern, ballast capacity and flow rate requirements etc. When ship owners want to decide on which BWTS to buy, the test reports should be open and transparent, including the environmental boundaries that the systems has been tested for (including salinity, suspended matter). If Lloyd's Register is approving a BWTS on behalf of the Administration, we try to represent all test results indicating the boundaries in which the BWTS demonstrated its compliance with G8 requirements. This includes all conditions as may be necessary to provide an informed summary of the performance specification of the BWTS. This will assist the ship owner when considering the selection of a suitable BWTS for is ship or fleet.

Are the type approvals by different class societies similar?
Yes they are, and with the common intent of ensuring that the BWTS complies with the particular Class requirements for installation on board ship. and contingencies are in place against the hazards from the BWTS that may affect the safety of the crew, ship and the environment. As the word "type approval" may be used widely it is important to read carefully the scope and the conditions of the approval issued on the certificate. Whatever the case, reference is to be made to each Classification society's requirements for compliance with their Rules.

When do ships need to be equipped with a BWTS? When will the BWMC be implemented?
For the BWMC to enter into force, another 5% of the world's tonnage is needed. This means that now, we have the time to learn, because the installation of BWTS is not mandatory yet. At IMO´s 65th MEPC Session, a draft Assembly resolution was approved which recommends that ships are not required to install a BWTS until its first renewal survey after entry into force of the BWMC. In general, we advise ship owners to act now. Some ship owners have already planned ahead by installing a BWTS and it can offer an opportunity for the crew to familiarise, operate and understand better the performance of the BWTS on their vessel. It can also provide opportunity to rectify any installation and performance related issues on the ship. Although the BWMC is not yet ratified, some national regulations may be required for ships visiting certain areas e.g. USCG, Canada, Australia etc. As such it is important for the ship to know these requirements in advance prior to making the trip. In general, we advise that it is best to act now and plan ahead to eliminate delays during retrofitting.

How does class see the role of ports?
Following MEPC 65, there are now guidelines for port state control implementation. Ports will be required to implement these procedures in addition to any specific requirements they may have. Ports will be required to be proactive and prepare on how to deal with non-compliances should such case arise during inspections. Where the BWTS are installed properly and operated within the boundaries of the

performance requirements as designed and certified, it will make it more easier to conduct inspections and verify records of operations.

5.6 RETROFITTING

Expert: Jurrien Baretta – Goltens Greens Technologies

What services does Goltens Green Technologies provide?
Goltens provides retrofitting services for ship owners. We can give advice about components and materials, but the client chooses the BWTS. Goltens then makes 3D-scans of engine rooms, makes a coarse layout of the retrofit of the BWTS and discusses the layout with the client for practicality. When the layout is accepted, Goltens produces detailed drawings (mm scale) of the piping and all components of the BWTS within the setting of the engine room. We can also arrange the pre-manufacturing of the piping and the components for fast installation, and supervise the installation of the BWTS.

How does Goltens deal with the coming peak in demand?
This should not be a problem when clients plan their retrofit well ahead of time. Goltens advises to take about 18 months in total for the total procedure (choosing, fitting and installing a BWTS), although this procedure can also be finished within 4 months. The installation of a BWTS can be planned during the scheduled docking of a ship (every 5 years). Installation can be accomplished within 2 weeks, so it does not have to be the delaying factor in the scheduled docking. But for this to be possible the installation of the BWTS should not be on the bottom of the priority list. The total time needed for a retrofit is mostly influenced by the delivery time of the BWTS, the size of the BWTS and the accuracy of the engine room diagram (solved by using a 3D-scan).

Are there standard designs and regulations for a BWTS retrofit?
Ships and BWTS's are not standardized, so it is very difficult to apply standard BWTS retrofit designs. Retrofitting is almost always possible by separating segments of the BWTS. Some general rules apply though, for instance it is best to put the filter close to the ballast pump for minimum pressure loss, and try to have as little additional piping as possible, to reduce production- and installation costs.

Can a BWTS be installed while the ship is in service?
This is possible if the BWTS is not too big and the retrofit is well-prepared. All materials and equipment need to be present on the ship and must be transportable to the location of installation (the 3D-scan will give a good indication if this is possible). Keep in mind that a blackout of the ship's control system is needed when the BWTS's sensors and alarms are connected to the control system.

Is a new ballast pump needed when a BWTS is retrofitted?
The existing ballast pump may be powerful enough, or it may be upgraded (new motor, new rotor, frequency control etc.). Rarely a new ballast pump is needed.

Are there solutions for difficulties when retrofitting a BWTS inside a tanker?
The main issue with tankers is that the BWTS cannot be installed inside the engine room for safety reasons. Solutions are to place the BWTS (-components) inside the pump room or inside the ballast tanks. A ballast tank may also be sacrificed to create space for the BWTS. Multiple pumps in tankers usually mean multiple BWTS's are needed (depends on the type of BWTS and the possibility of

connecting the ballast tanks via piping). Goltens is still actively trying to find solutions when the tanker uses submersible pumps instead of a pump room.

5.7 COMPLIANCE, MONITORING AND ENFORCEMENT (CME)

Experts: Kees Hak – Dutch Human Environment and Transport Inspectorate / Louis Peperzak and Cees van Slooten – Royal Netherlands Institute for Sea Research (NIOZ)

Are there methods for monitoring ballast water on board?

Yes and they can give you an inidcative result within minutes. *Followed by demonstration of hand-held devices: two fluorometers (Hach and Turner Design) and an ATP-meter.*

What do these hand-held devices measure exactly?

They give an indication of gross non-compliance. Fluorometers measure living algae (phytoplankton) larger than 1 um. The ATP meter measures all living cells larger than 10 µm. ATP is only present in living cells and therefore is an indication of the concentration of living cells in a sample.

Is the small sample representative?

For measuring gross non-compliance, it is representative. For the ATP-meter, a result of <1000 relative luminescence units indicates compliance. So one sample measured with a hand-held device can only be an indication of gross non-compliance.

How much do the indicative CME instruments cost?

Roughly 2000−5000 euro depending on the instrument.

All these devices do not look at organisms > 50 µm?

They can, but organisms larger than 50 µm are usually filtered out as most BWTS have a filter of 50 µm (or smaller).

How about measuring bacteria?

Three specific bacteria groups are regulated by the IMO. Tests for these three species cannot be performed by the above mentioned rapid compliance techniques. General bacterial presence could be monitored using ATP analysis. Other techniques are needed to measure specific bacterial species or strains of bacteria. Techniques to count specific bacterial species have the disadvantage that they take at least a few hours. Mass spectrometry of bacteria might be an option, but those tests take at least eight hours to get a result.

How long does it take to teach the vessel crew how to use the instruments?

About an hour. A detailed manual or instruction video would be sufficient.

What is the B-box? Where is it available?

The B-box is a 'do it yourself ballast water monitoring kit'. It is available all over the world. It was developed in 2013 by NIOZ and field tests have been done in United States, Turkey and Portugal. The B-box samples are tested with indicative tests (measuring gross non-compliance) but it can also give more detailed information on the performance of a ballast water system by counting organisms and by

measuring chemical variables. The box has to be back at the laboratory within 5 days and the samples should stay under 10 °C (more information on *www.ballastwaterbox.nl*).

What is the procedure for CME at ports?
Three aspects will be checked (1) all documents (BWTS type approval, certificates etc.), (2) does the crew know how to work with the BWM system?, (3) past record of the BWTS (breakdowns or other irregularities?) or failure to meet the D-2 Standard. A ports officer has 3-4 hours to check 60 aspects onboard a ship, of which ballast water is only one, therefore a more thorough look at the BWTS is only done if there is an indication of non-compliance, for instance if the BWTS has no type approval, or if it shows an error message. Next week, another training will be given to port state control officers about ballast water sampling.

Will there be a guideline for PSC so that sampling will be the same everywhere?
If the results should be used as legal proof, the samples cannot be analyzed by port state control. The analysis of the samples will most likely be done externally, by a specialized lab, if there is a reason for suspicion of non-compliance. No clear rules and procedures yet in all North Sea countries.

When does port state control come and test?
PSC decides on an individual ship basis when they want to do it.

What is the procedure if a ship is non-compliant?
A non-compliant sample of a CME method which was tested by a port state control officer would be reported to the IMO but would at the moment NOT lead to detention or fines. The ship will be marked in the documents to come in to consideration of more detailed examination.

How long will be the trial period after BWMC's entry into force?
No specific trial period was mentioned in the last MEPC to avoid scaring countries with the implementation. The message is: we are all learning! The inspectorate expects the trail period to be 2-3 years.

5.8 US REGULATIONS

Expert: Jon Stewart – International Maritime Technology Consultants Inc.

What is the regulatory framework in the USA?

US regulations are made by the Environment Protection Agency - EPA (based on the Clean Water Act) and the US Coast Guard (Invasive Species Act). None supersedes the other and each organization has its own tasks and responsibility. The synchronization between these two bodies does not always work perfectly; it can be a difficult marriage. The Vessel General Permit under the Clean Water Act (new in 2013; valid for 5 years) is a typical EPA product. It has the same standards as the USCG but uses different procedures. Under the CWA ships are regarded as point-source polluters. Self-monitoring is required and forms should be filled in and sent to the EPA.
In the US, the federal government cannot supersede the laws and regulations of individual states; especially the State of California has its own and often very stringent rules (sometimes with unrealistic demands). Generally, the Federal Law forms the basis, but States can be more stringent (not less stringent).

The US coast is divided into a number of 'Captain of the Port (COTP) Zones'. Only ships which ALWAYS remain within a single COTP are exempted from ballast water treatment rules.
The current regulations in the USA should be regarded as a blue print for a final structure, but not as the final structure itself. This means that stakeholders can still have influence on the developments.

What is the structure of an Independent Laboratory (IL)?

If a manufacture wants to know whether his test results a good enough for judgment according to the ETV protocol, he can offer the package to an IL. There are currently 2 Independent Labs vetted by the US Coast Guard: an American consortium led by NSF International and a European Consortium led by DNV. Land-based and Ship-board testing should be carried out according to the ETV protocol. The procedures described in the ETV protocol are more prescriptive than those written in the IMO guidelines. For instance, toxicological screening of the effluent of a BWTS should occur according to rules of the EPA. Environmental test (vibrations tests, corrosion tests) should also be carried out.

What is currently the best strategy for a BWTS manufacturer: apply for Independent Lab Type Approval or go for AMS acceptance?

In the US, there currently is no system which has been type approved by an independent lab. This is expected to happen in the coming 18-24 months. Therefore a request by a manufacturer for an Alternative Management System Acceptance (which is DIFFERENT from US type approval!) is a good investment now and in the next year when you already have an installation which has obtained Type Approval from a foreign administration. I have guided 16 applications of manufactures for AMS approval. The benchmark for obtaining AMS is not D2 standard that the biological efficacy of the treatment should be at least as efficient as ballast water exchange in the open sea (IMO D1). This is less stringent than the criteria stated in D2 and the Final Rule of the US Coast Guard, which are identical. So the fact that AMS acceptance is issued by the USCG does not guarantee an IL type approval for the BWTS at a later stage! AMS acceptance has to be requested by the manufacturer but is issued to a particular ship. It is a bridging strategy with a guaranteed validity of 5 years after the compliance date of the ship. The compliance date is the first scheduled dry-docking after the start date. With this in mind it is possible to stretch the period before the compliance date to more than 5 years, maximum about 8 years from now.

Did the US already issue a procedure for ship-board testing?
No. And a ship-board test protocol may not be ready before the end of 2014. I am a member of the ETV R&D panel developing this, and for the moment I advise to use the Quality management System for land-based testing also for ship-board testing.

What are the current difficulties for UV-based systems to fulfill the ETV criteria?
The efficacy of systems is determined by counting live and dead cells with a staining technique based on the activity of certain enzymes instead of counting 'viable cells' in the sense of cells being able to reproduce. Therefore an alternative measurement protocol is sought at the moment by an international technical panel. When agreement is reached about such a method, it must first be validated by different test centers. Since this might take 1-3 years, UV system manufacturers better apply for AMS acceptance instead of striving for IL Type Approval.

What are the plans in the US for compliance monitoring?
The methods Port State Control will use are currently under development. It will likely be a tiered approach. In tier one, inspections will include whether the required forms are filled in, the crew has sufficient knowledge about the operation of the BWTS and whether the BWTS has been operated according to the manual. In tier two, rapid tests will be carried out to check whether the BWTS is certainly non-compliant (e.g. PAM fluorometry for algae, ATP for all forms of life: measuring gross non/compliance). Tier 3 involves full-scale testing and counting life/dead organisms with equipment specially brought on board for this purpose; e.g. a skid-mounted filtration unit. There will be a five year review period for the different methods used. Only the US Coast Guard carries out inspections on board, also on behalf of the EPA. The latter relies on self-monitoring of ships entering US waters.

Those who falsify papers and/or piping on board may face imprisonment! Ships on flags with a bad reputation stand a bigger chance to be selected for inspection.
As far as the compliance dates are concerned, a ship-owner can ask for an extension for his ships. The template for this letter is on the coast Guard's website. It should be sent to the USCG AT LEAST 12 months before the first scheduled dry-docking originally counting as compliance date.

5.9 OTHER REMARKS DURING CAFÉ MEETINGS

Two other important general remarks made during café meetings:

- **How about sediments in the ballast water tanks?** Concern expressed by a Captain, saying there is no machinery equipped to remove sediments from tanks, while at the same time sediments contain 70% of the pollution (i.e. life forms). According to him, treating only the ballast water is not enough, because then you tackle only 30% of the problem. As a solution, he optioned jet propulsion: re-suspension of sediment organisms in the water so that the treatment system can reach them.
- **Reverse osmosis: is ballast water suitable for the production of drinking water?** BWTS's are not designed to produce water of drinking quality, ballast tanks may contain rust + low oxygen levels + chemical residues of the BWTS, electro chlorination poses a real problem for reverse osmosis, it's much better to use ocean water for this purpose.

Should you have more questions to one of the experts, please send a message to info@northseaballast.eu and you will be provided with contact details of the expert.

6 A SHIP OWNER'S PERSPECTIVE

By Hans Huisman – Maritime Consultant

Mr. Huisman served as a deck officer on tankers. After graduating in Naval Architecture, he was involved in the design of container vessels and ferries. In 2003 he joined E.R Schiffahrt in Hamburg as Senior Director Newbuildings. Nowadays he is an independent maritime consultant. Mr. Huisman prepared the application of BWTS for the E.R. Schiffahrt fleet of container vessels, bulkers and offshore vessels.

Current issues

- **Regulatory issues**
  - USA may reject IMO type-approved systems even after installation.
  - Fundamental mistake by uncoupling approval and functionality.
  - Standards are too stringent.
- **Approval issues**
  - Type approval means that the system has passed the type approval tests.
  - Ships have the obligation to discharge "clean" water in a dynamic environment.
  - Basic, Final, Type and Class approval may not guarantee a working system under all circumstances.
  - Active substances may be banned in future.
- **Technical issues**
  - Filters seem to be a headache; e.g. bulkers encounter filter problems.
  - Existing vessels are not built for additional power consumption and additional backpressure in the ballast system.
  - Despite the laboratory testing, do not believe in proper filter-cleaning on ballast pump pressure only.
  - How to handle your ballast in dry-dock.
- **Operational issues**
  - Not one single system is suitable for all ship- types.
  - During interim period no "criminal" action.
  - Supply of active substances to the vessel.
  - Sampling of water, proper transport to nearby laboratory.
  - Discrepancy between time for testing and harbour time of vessel.
  - Fresh water performance / power demand

Result

The ship owner is the only party that is made responsible for proper choice of BWTS. The future is uncertain. No proper on-board testing procedures are in place (yet). Any investment in BWTS is out-of-pocket money.

How to minimise this risk

1. Calculate for each vessel in your fleet the application date (IMO & USCG). Make use of grace periods for dry-docking
2. Determine for which vessels it is not worth anymore to install BWTS. Create a proper exit scenario for those vessels
3. Read BWTS documentation of ABS and LR
4. Determine capacity of BWTS for each vessel. One ballast pump only / Complete pump capacity (i.e. bulkers)
5. Determine company policy regarding BWTS: Filter or no filter / Poison or no poison / HSE danger for crew (Ozone, Hydrogen) / Proven technology or not
6. For systems using active substances read the IMO documentation for basic and final approval. Here you read what is happening i.s.o. the marketing one-liners
7. Make a shortlist of systems you expect to work: Reliability of supplier / BWTS included in AMS system? / Operational simplicity / Supply of "chemicals" (including neutralization agents)
8. Make a short list of suppliers
9. Prepare questions / discussion points for the suppliers. Discuss:
    - details about the connection to the ship's automation system?
    - the start-stop procedures.
    - what happens if disinfection part is not working.
    - alarm management
    - capital costs and operational costs.
    - the space needed and the flexibility of installation
    - the scope of supply (incl. laser measurements?)
    - crew training
    - implications on tank coating (if any)
10. Distribute the questionnaire and receive answers
11. Evaluate the answers and produce Key Performance Indicator (KPI) for each system. The KPI I used was: *price* × *pressure drop* × *kW*
12. Produce your own operational cost calculation with your fleet data.
13. Reduce your shortlist
14. Throw a dice and decide which system(s) will be used in your fleet
15. Make arrangements for a test-installation

NORTH SEA BALLAST WATER

European Union The European Regional Development Fund

The Interreg IVB North Sea Region Programme

Investing in the future by working together for a sustainable and competitive region