ASEF 2009
3-4 December 2009

Development of Ballast Water Treatment System according to the IMO Convention

Techcross Inc. **NAM DAE HEO**

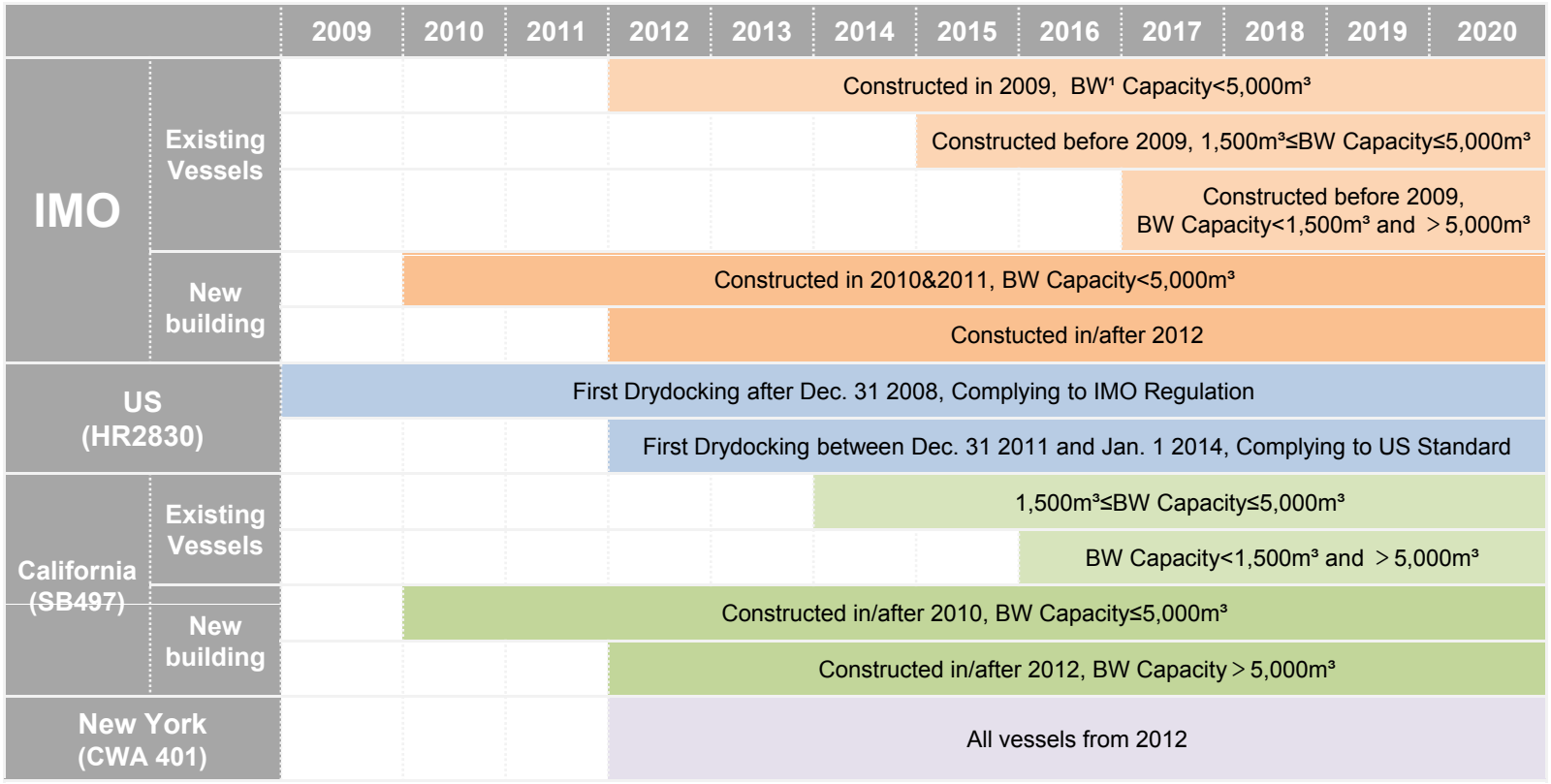
IMO Ballast Water Management Convention

Diplomatic Conference in February 2004 has adopted the

International Convention
for the Control and Management
of Ship Ballast Water and Sediments,
2004

- The Convention comes into force 12 month after 30 countries representing over 35% of world tonnage have ratified the Convention
- As of today, 18 countries representing 15.27 % of world tonnage have ratified

BWM Convention Time Schedule



Ballast Water Treatment Performance Standard

Organism Size Class	IMO Regulation D-2	US HR2830	California SB497	New York [1] CWA401 Construction After Jan. 1, 2013
＞50um	<10 per 1ton	<1 per 10ton	No detectable living organisms	No detectable living organisms
≥10um, ≤50um	<10 per 1ml	<1 per 10ml	<0.01 per 1ml	<0.01 per 1ml
<10um			$<10^3$ bacteria/100ml $<10^4$ viruses/100ml	$<10^3$ bacteria/100ml $<10^4$ viruses/100ml
Vibrio cholera	1cfu/100ml or 1cfu/1wet weight gram	1cfu/100ml or 1cfu/1wet weight gram	1cfu/100ml or 1cfu/1wet weight gram	1cfu/100ml or 1cfu/1wet weight gram
Escherichia coli m^3	<250cfu/100ml	<126cfu/100ml	<126cfu/100ml	<126cfu/100ml
Intestinal enterococci	<100cfu/100ml	<33cfu/100ml	<33cfu/100ml	<33cfu/100ml
Remark		No discharge of living organism by 2015	No discharge of living organism by 2020	

[1] New York: Performance Standards are the same as US HR2830 by Jan. 1, 2012

BWM Convention Time Schedule of USCG

Phase - 1

Ballast water discharge standard (BWDS)

For organisms larger than 50 microns in minimum dimension:	For organisms equal to or smaller than 50 microns and larger than 10 microns:	Bacteria		
		Toxicogenic Vibrio cholerae (serotypes O1 and O139)	Escherichia coli	Intestinal enterococci
Discharge less than 10 per cubic meter of ballast water	Discharge less than 10 per milliliter (ml) of ballast water	A concentration of <1 colony forming unit (cfu) per 100 ml	A concentration of <250 cfu per 100ml;	A concentration of <100 cfu per 100 ml.

Implementation schedule

	Vessel's ballast water capacity (cubic meters, m^3)	Vessel's construction date	Vessel's compliance date
New vessels	All	On or after January 1, 2012	On delivery.
Existing vessels	Less than 1500	Before January 1, 2012	First drydocking after January 1, 2016.
	1500–5000	Before January 1, 2012	First drydocking after January 1, 2014.
	Greater than 5000	Before January 1, 2012	First drydocking after January 1, 2016.

BWM Convention Time Schedule of USCG

Phase - 2

For organisms larger than 50 microns in minimum dimension:	For organisms equal to or smaller than 50 microns and larger than 10 microns:	For organisms smaller than 10 microns	Bacteria		
			Toxicogenic Vibrio cholerae (serotypes O1 and O139)	Escherichia coli	Intestinal enterococci
Discharge less than 1 per cubic meter of ballast water	Discharge less than 1 per milliliter (ml) of ballast water	(i) Discharge less than 103 living bacterial cells per 100 ml of ballast water; and (ii) Discharge less than 104 viruses or viral-like particles per 100 ml of ballast water; and	A concentration of <1 colony forming unit (cfu) per 100 ml	A concentration of <126 cfu per 100ml;	A concentration of < 33 cfu per 100 ml.

Implementation schedule

(c) Table 151.1512(c) Implementation Schedule for the Phase-Two Ballast Water Management Program

Vessel's ballast water capacity (cubic meters, m^3)	Vessel's construction date	Vessel's compliance date	
New vessels	All	On or after January 1, 2016	On delivery.
Existing vessels	All	Before January 1, 2016	First drydocking after January 1, 2016, UNLESS the vessel installed a BWMS meeting the phase-one standard before January 1, 2016, then 5 years after installation of the BWMS meeting the phase-one standard.

BWTS IMO Final Approved System

	Manufacturer	Country	System Name	Technology
1	Techcross Inc.	Korea	Electro-Cleen	electrochemical oxidation + neutralizing agent (sodium thiosulfate)
2	OceanSaver	Norway	OceanSaver BWMS	filtration + cavitation + nitrogen supersaturation + electrodialysis
3	Hamann Evonik Degussa	Germany	SEDNA System	hydrocyclone + filtration + biocide (Peraclean Ocean)
4	Alfa Laval	Sweden	PureBallast	filtration + advanced oxidation technology (hydroxyl radicals)
5	Greenship Ltd	Netherlands	Sedinox	hydrocyclone + electrolytic chlorination
6	Hitachi	Japan	ClearBallast	coagulation + magnetic separation + filtration
7	NK-O3	Korea	BlueBallast	ozone
8	RWO Marine Water Technology	Germany	CleanBallast	filtration + advanced electrolysis

Note : Three more technologies are expected to get final approval at MEPC 60

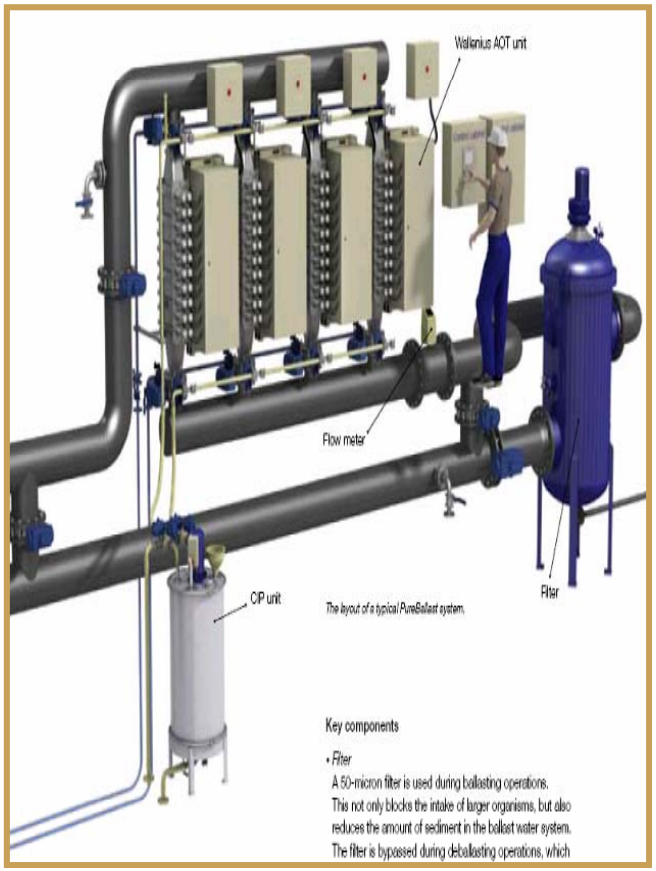
Technical evaluation of the feasibility of installing BWMS

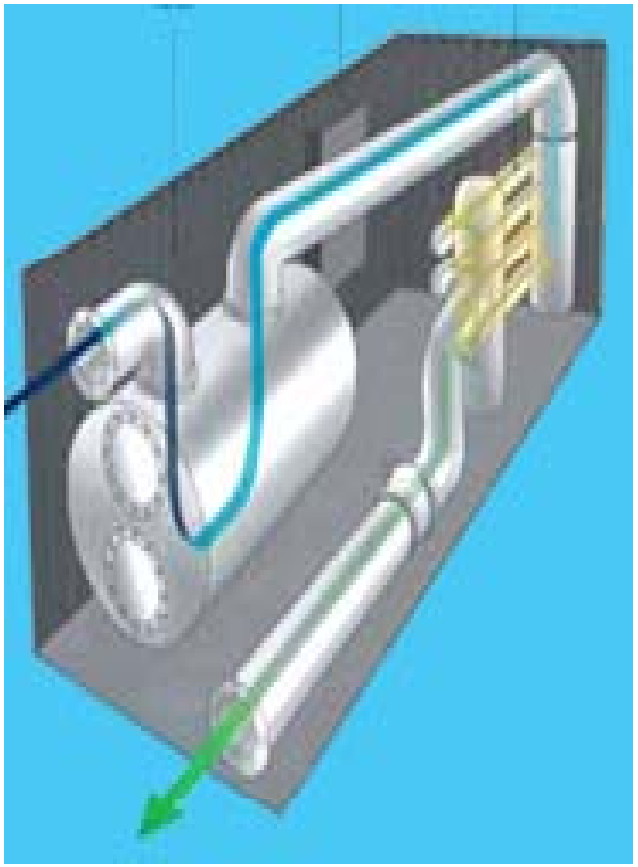
UV	• Enlarge generator capacity or add generator
Filter	• Increase the output pressure of pumps
Chemical	• Consider the position and structure of the storage tanks & piping requirement

BWTS Technologies

Filtration + AOT (Advanced Oxidation Technology) or UV

- Power Consumption
-UV Lamp exchange (Opex)
-Treat at both ballast & deballast



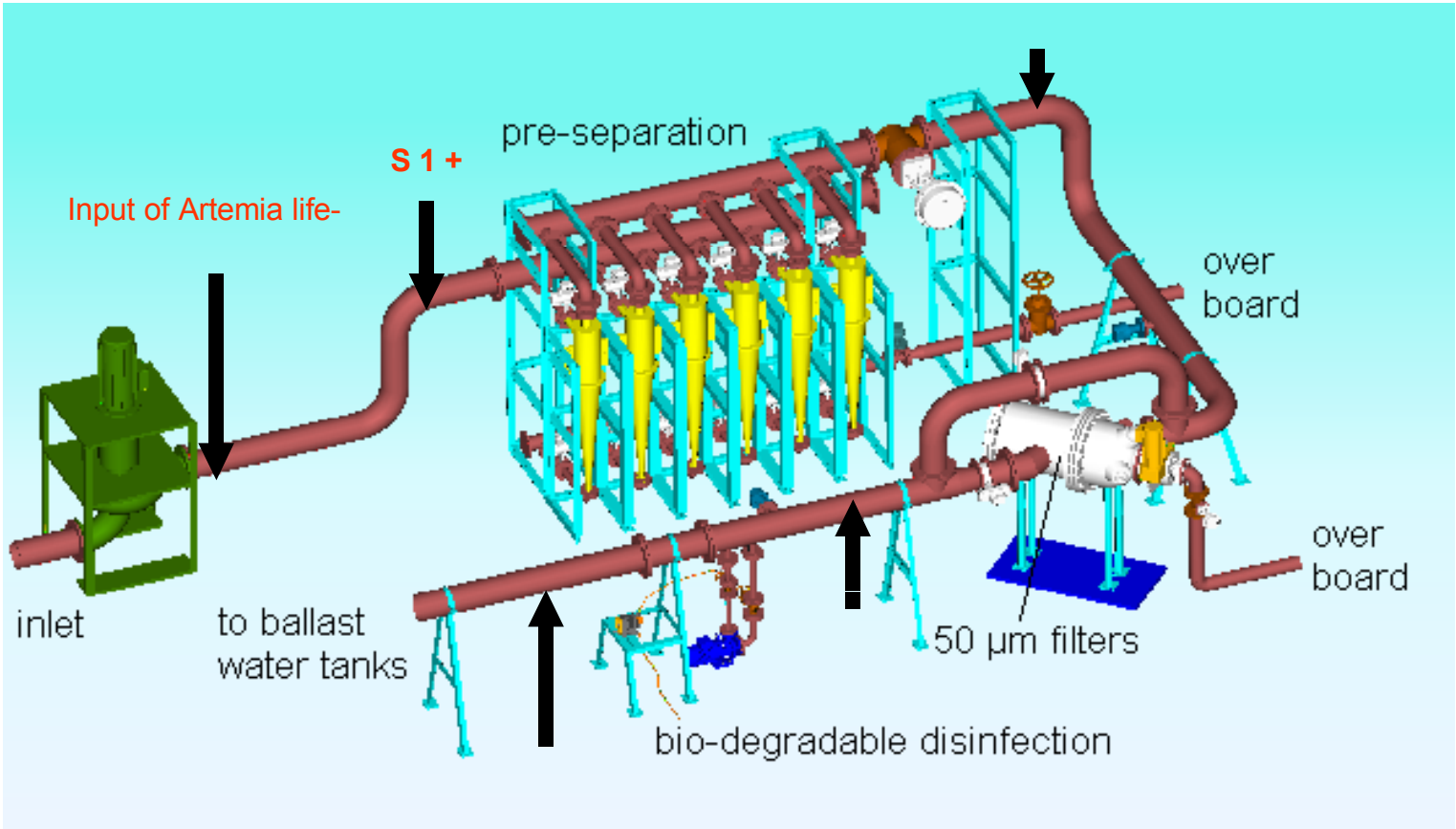


3) CIP (Cleaning In Place)

BWTS Technologies

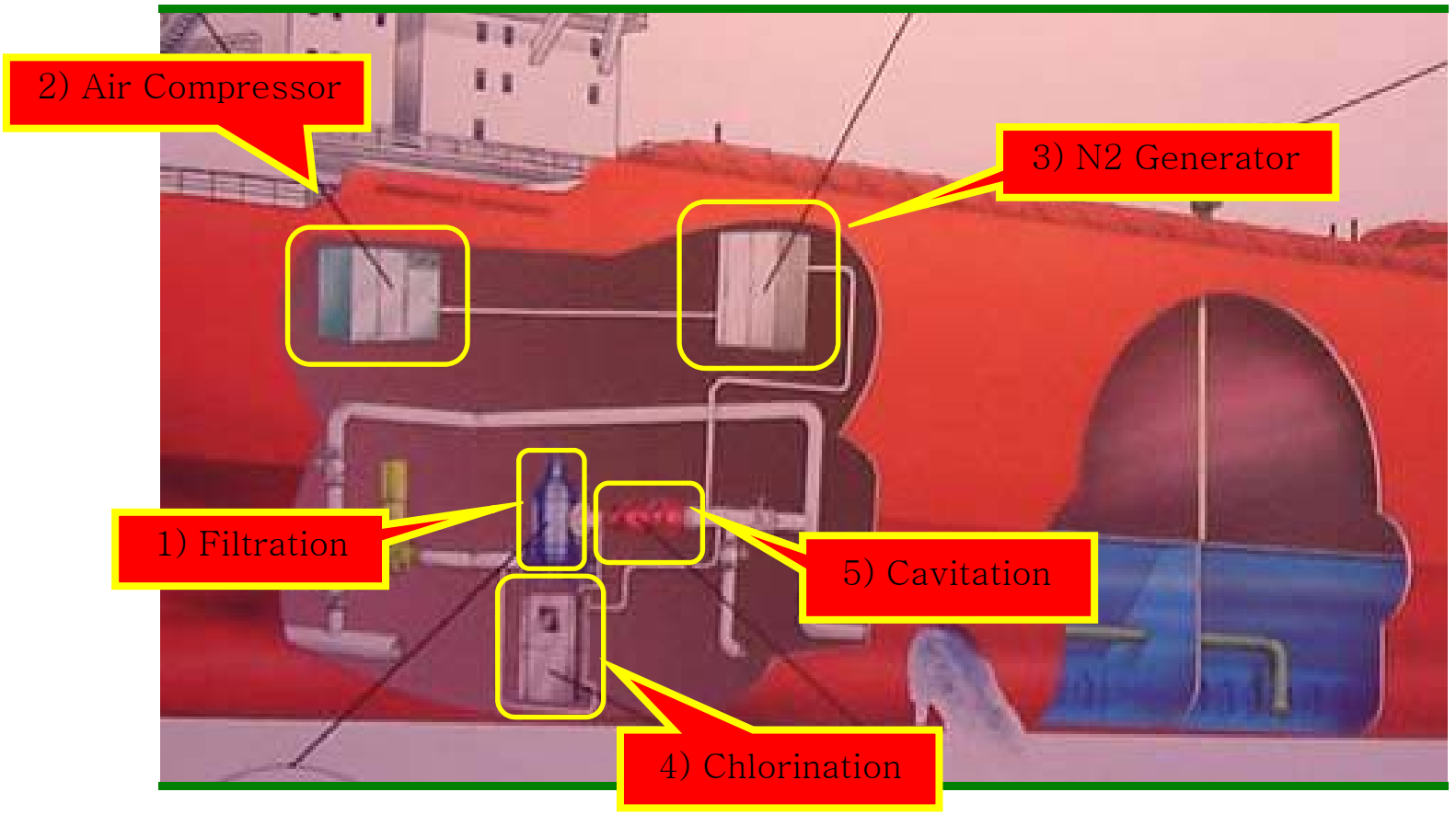
Filtration + Chemical injection

- Filter
- Chemical on board
- Dimension



BWTS Technologies

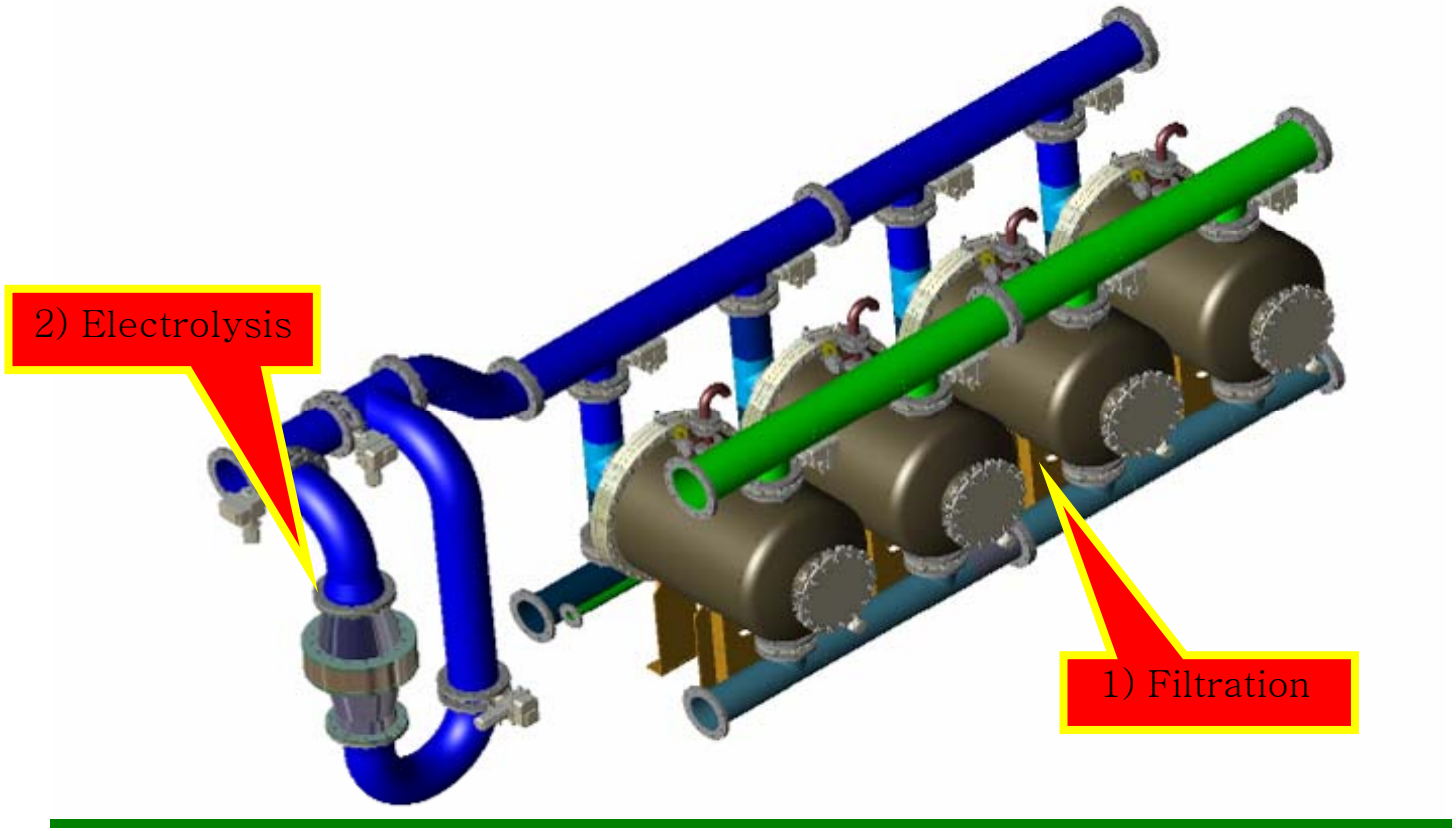
Process : Filtration + Cavitation + Deoxygenation + Chlorination



BWTS Technologies

> Process : Filtration + Electrolysis

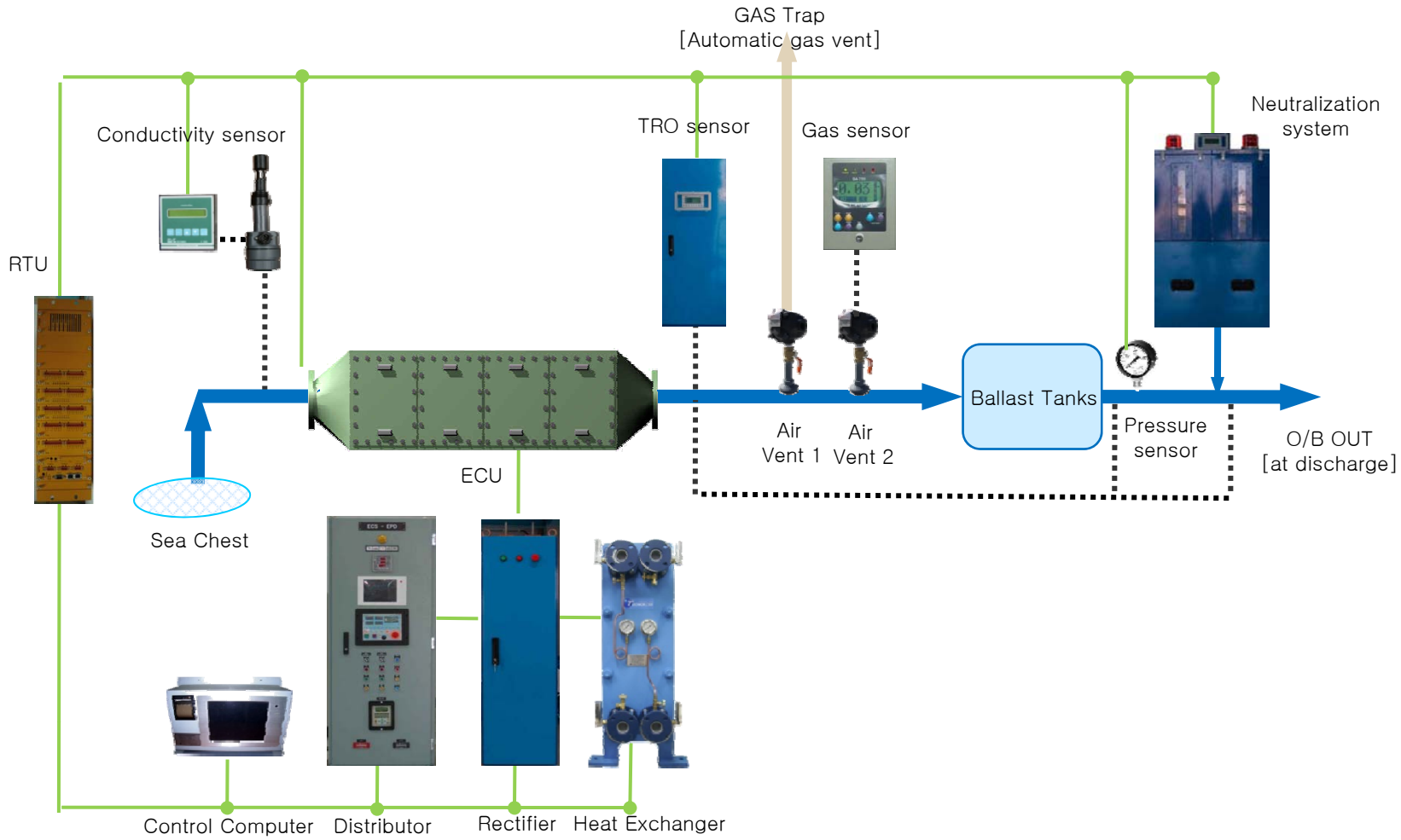
- Filter
- Retreatment at Discharge
- Dimension
- Neutralisation required



BWTS Technologies

Electro Cleen System –Techcross

Process : Electrolysis + Neutralization



TECHCROSS Installation Reference

1,000TEU Container ship

Chemical Tanker-Pump Room Installation

Chemical Tanker - On-Deck Installation

27K DWT Bulk Carrier

California Recommendation

OCTOBER 2010 UPDATE : Ballast Water Treatment Technologies for use in California waters - October 15,2009

Conclusions

Based on the available data, at least seven ballast water treatment systems: AlfaLaval, Ecochlor, Hamann Evonik Degussa, Hyde Marine, OceanSaver, OptiMarin, and Techcross have demonstrated the capability to comply with California's performance standards for the discharge of ballast water. AlfaLaval (Norway), Hyde Marine (United Kingdom), Hamann Evonik Degussa (Germany), OceanSaver (Norway), and Techcross (Korea) have received Type approval from flag state administrations. All seven systems are commercially available at this time. We expect several more systems to meet California's standards in the near future.

The seven systems that have demonstrated the capability of complying with California's performance standards have at least one testing replicate, at either full-scale land-based or shipboard scale that demonstrates compliance with the standards. Vessel owners/operators should closely scrutinize the available data, however, to ensure that systems will meet California's standards on a regular basis given the configuration of the vessel and piping/water flow requirements.

California's Assessment of Efficacy

Table 4 (continued). Summary of systems with available results for assessment of efficacy

Systems with at least one replicate in compliance with the performance standards are denoted by a "Y" in the appropriate column in Table VI-1. Non-compliance is denoted by an "N," and those systems with data in metrics not directly comparable to the performance standards were designated as "unknown." Blank cells represent systems with incomplete data. Shading indicates systems had no data available.

Manufacturer	> 50 µm		10 - 50 µm		< 10 µm (bacteria)		*E. coli*		Enterococci		*V. cholerae*		References[3]
	IMO	CA	IMO	CA	IMO	CA[1,2]	IMO	CA	IMO	CA	IMO	CA	
MARENCO	Y	Y	Y	N	N/A	Y							27,28,57
Maritime Solutions Inc.					N/A								
MH Systems*	Y[5]	Y[5]			N/A		Y	Y	Y	N	Unknown		13,19
Mitsubishi Heavy Ind.					N/A								
Mitsui Engineering	Y	N	Y	Unknown	N/A	Unknown	Unknown		Unknown		Unknown		21,23,24
NEI	Y	Y	Y	Unknown	N/A	N	Y	Y	Y	Y	Y	Y	51,52,53
NK-03					N/A								
ntorreiro					N/A								
Nutech 03 Inc.	Y	Y	Y	N	N/A	Y	Y[4]	Y[4]	Y[4]	Y[4]	Y[4]	Y[4]	17,48,60
OceanSaver	Y	Y	Y	Y	N/A	Y	Y	Y	Y	Y	Y[4]	Y[4]	2,45,54
OptiMarin	Y	Y	Y	Y	N/A	Y	Y	Y	Y	Y	Y[4]	Y[4]	4,22,42,56
Panasia Co. Ltd.					N/A								
Qingdao Headway Tech.					N/A								
Resource Ballast Tech.					N/A								
RWO Marine Water Tech*	Y	Y	Y	Y	N/A		Y	Y	Y	Y	Y[4]	Y[4]	12,38
SeaKleen (Hyde)*	Y	Y	Y	Y	N/A	N	Y	Y	Y[4]	Y[4]			3,6,14,30,61
Severn Trent DeNora	Y	Y	Y	Y	N/A	Y							16
Siemens					N/A								
Sunrui CFCC					N/A								
Techcross Inc.*	Y	Y	Y	Y	N/A	Y	Y	Y	Y	Y	Y[4]	Y[4]	25,26,37

[1] Bacteria were assessed through examination of aerobic culturable heterotrophic bacteria (expressed as colony forming units).

[2] No methods exist to quantify and assess the viability of viruses at this time.

[3] Numbered references can be found in Literature Cited section

[4] Concentration at intake was zero or non-detectable

[5] Selected species only (sea urchin larvae, brine shrimp)

* New data available for this update

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Thanks for your attention

Techcross Inc. **NAM DAE HEO**