Ballast Water Treatment

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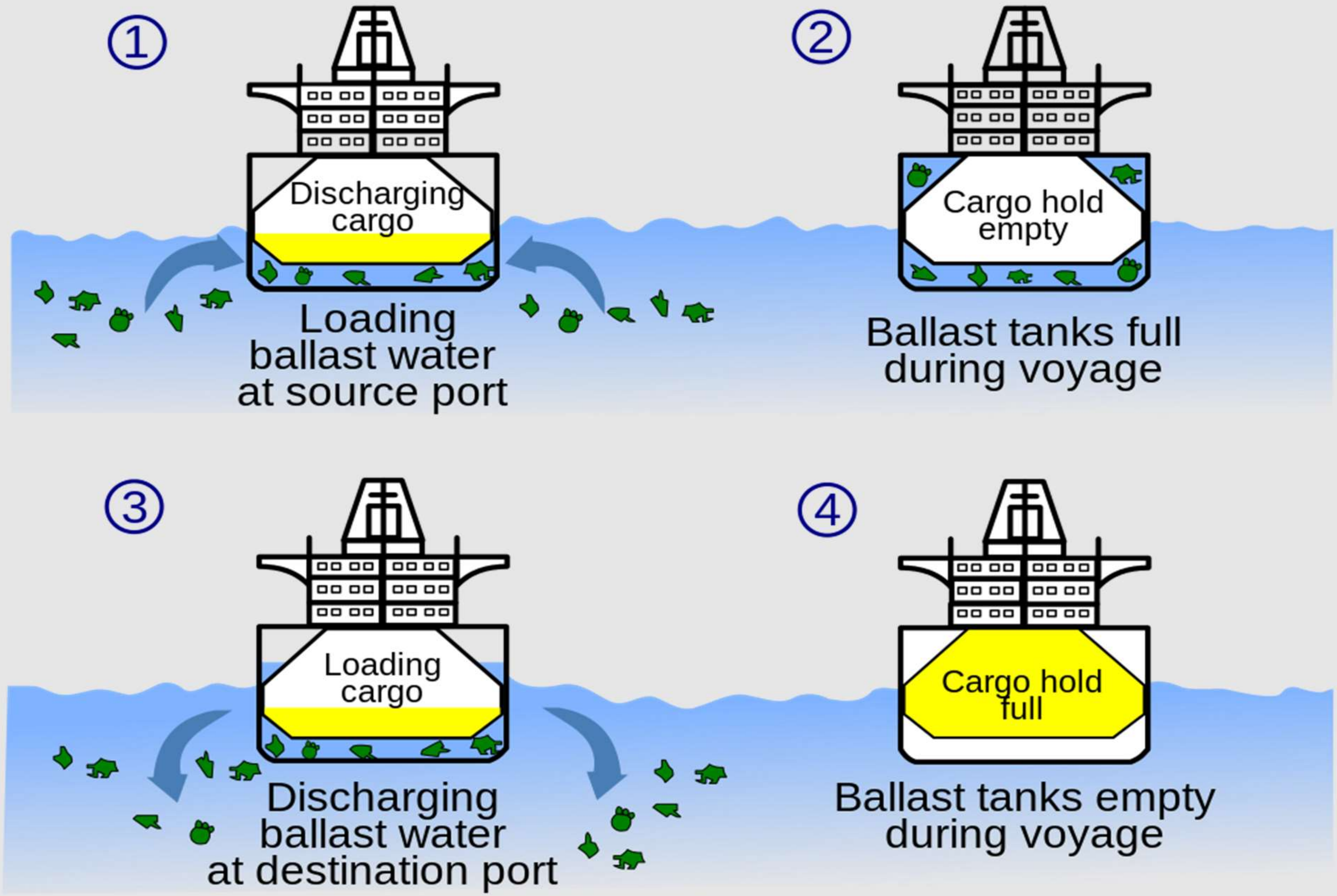
What is Ballast Water?



Problems

- Major threat to the environment, public health and the economy because of transferring invasive aquatic species
- 9 billion tonnes of ballast water are discharged each year
- 7000 species are carried in a ballast tank at any time
- The ecological effects and changes caused by invasive species are permanent & irreversible

The zebra mussel transferred into the North American Great Lakes from the Black Sea in 1988. The tiny mollusc multiplied uncontrollably, starving out native mussel populations and interfering with human structures from factory intake pipes to ship rudders. They've now spread from Canada to Mexico and are considered a major nuisance species. Hundreds of millions of dollars are spent annually to control their numbers.

Regulations

The International Convention for the Control and Management of Ships' Ballast Water & Sediments, 2004

ALL

Resolution MEPC.279(70) Revised G8
2016 GUIDELINES FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS (G8)
Applicable for all vessels installing a BWMS post 28 October 2020

Chemical only

Resolution MEPC.169(57) G9
PROCEDURE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS THAT MAKE USE OF ACTIVE SUBSTANCES (G9)

IMO

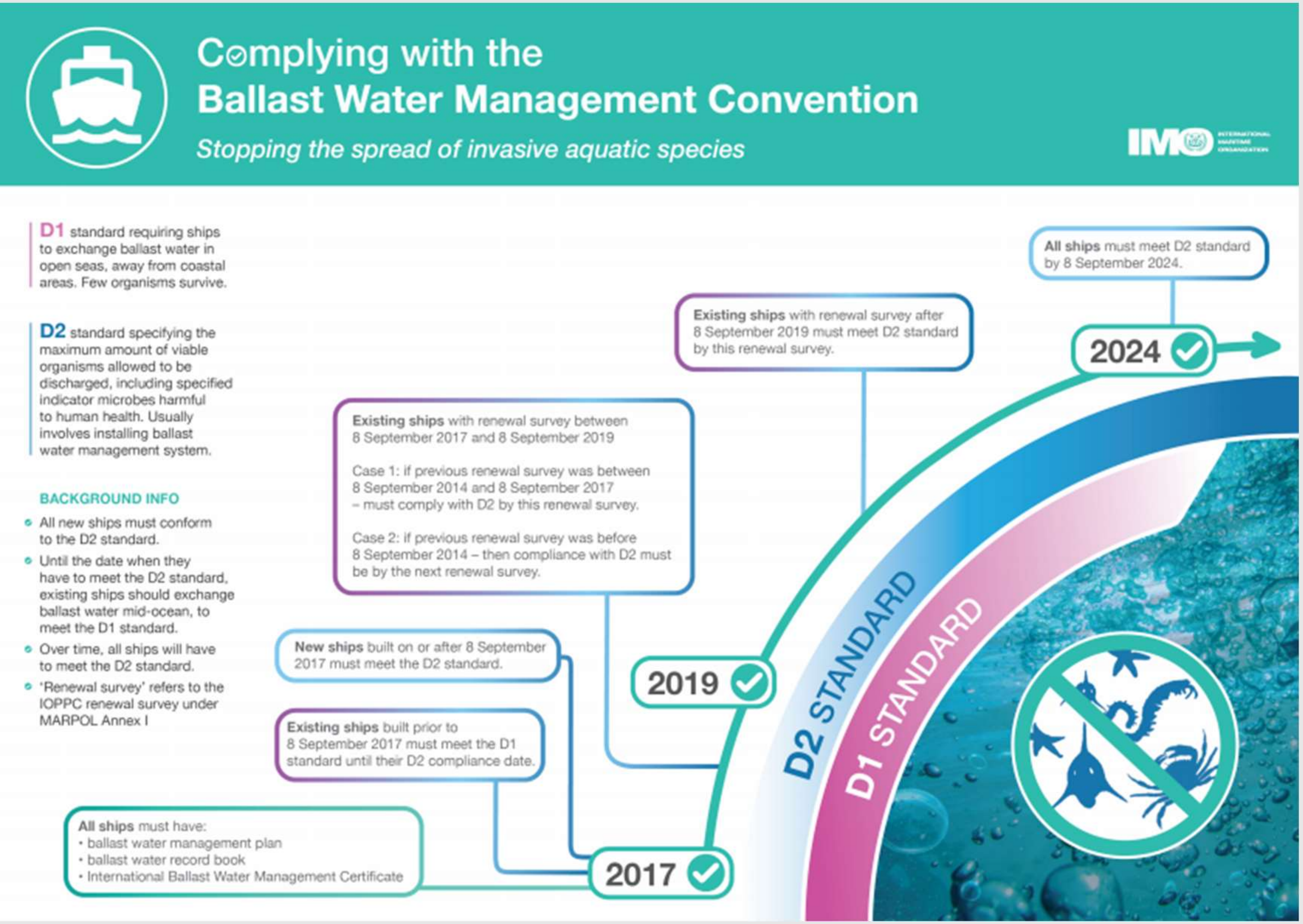
USA

33 CFR Part 151 Subpart D
Ballast Water Management for the Control of Nonindigenous Species in Water of the United States

46 CFR Part 162.060
Ballast Water Management Systems (Type Approval procedures and requirements)

Environmental Protection Agency Vessel General Permit 2013 (EPA VGP 2013)

Regulations



International Oil Pollution Prevention Certificate (IOPP)

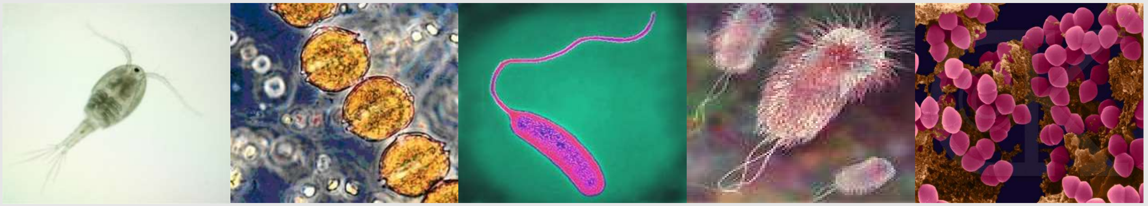
The IOPP certificate is issued to each new ship after an appointed surveyor has inspected it and found it to be in compliance with the MARPOL convention, it needs to be renewed every 5 years.

Regulations

Untreated Water

REGULATIVE STANDARD

Organisms >50μm in minimum dimension	<10 viable* organisms / m^3
Organisms ≥50μm<10μm in minimum dimension	<10 viable* organisms / ml
Toxigenic Vibrio Cholera	<1 cfu / 100ml or, <1 cfu / gram wet weight zooplankton samples
Escherichia coli	<250 cfu/100ml
Intestinal Enterococci	<100 cfu/100ml



* USCG substitute Viable for Living

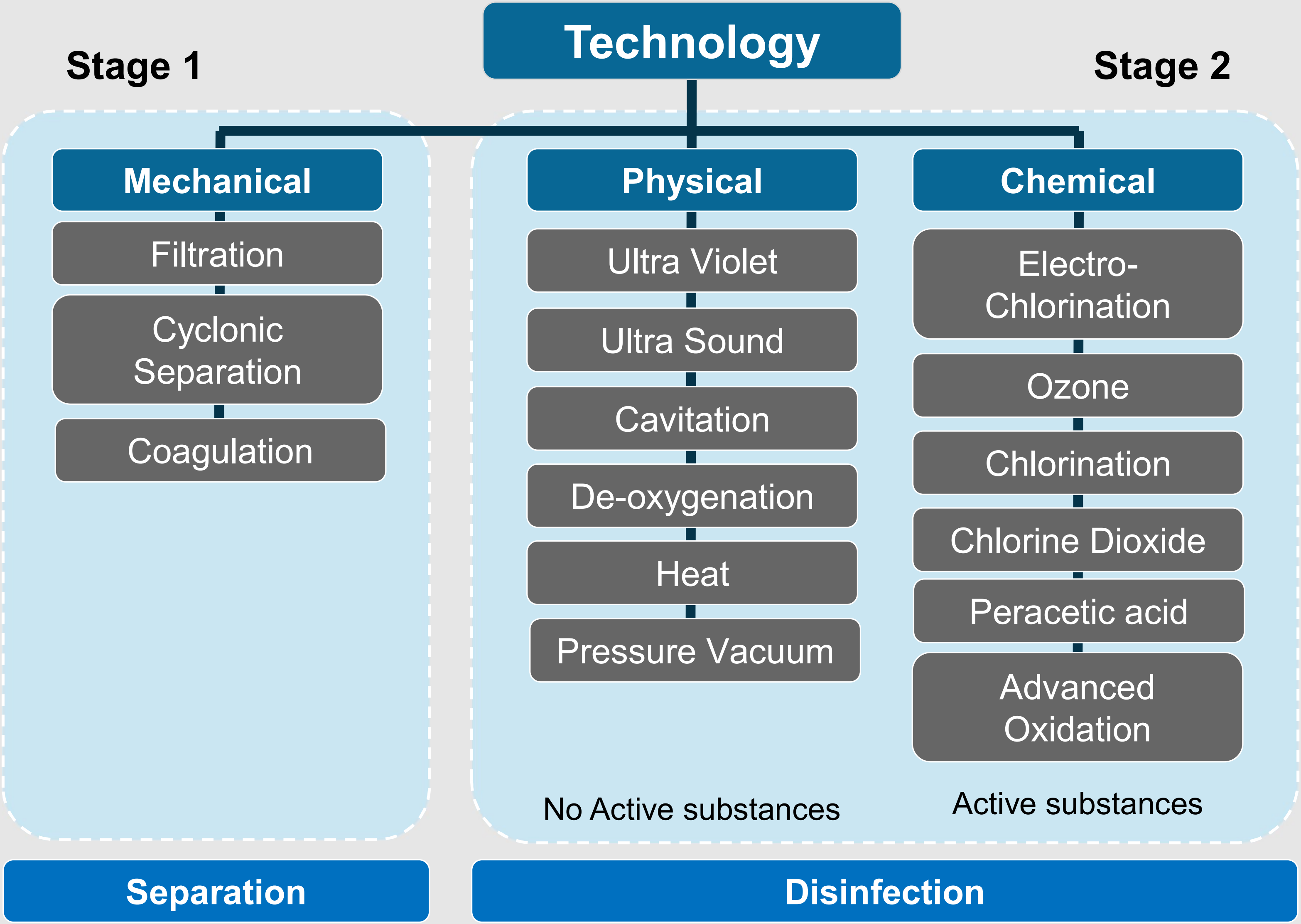
Regulations

The final Rules prohibit all vessels with ballast tanks to discharge untreated Ballast Water into US waters.

As in the IMO BWM Convention, there is an implementation schedule depending on the **ballast water capacity** and construction date of the vessel.

	Year of construction	Ballast Water Capacity	Compliance Date
New Vessels	On or after 1st December 2013	All	On delivery
Existing Vessels	Before 1st December 2013	< 1500 m3	First scheduled drydocking after 1st January 2016
		1500 - 5000 m3	First scheduled drydocking after 1st January 2014
		> 5000 m3	First scheduled drydocking after 1st January 2016

Technical solutions

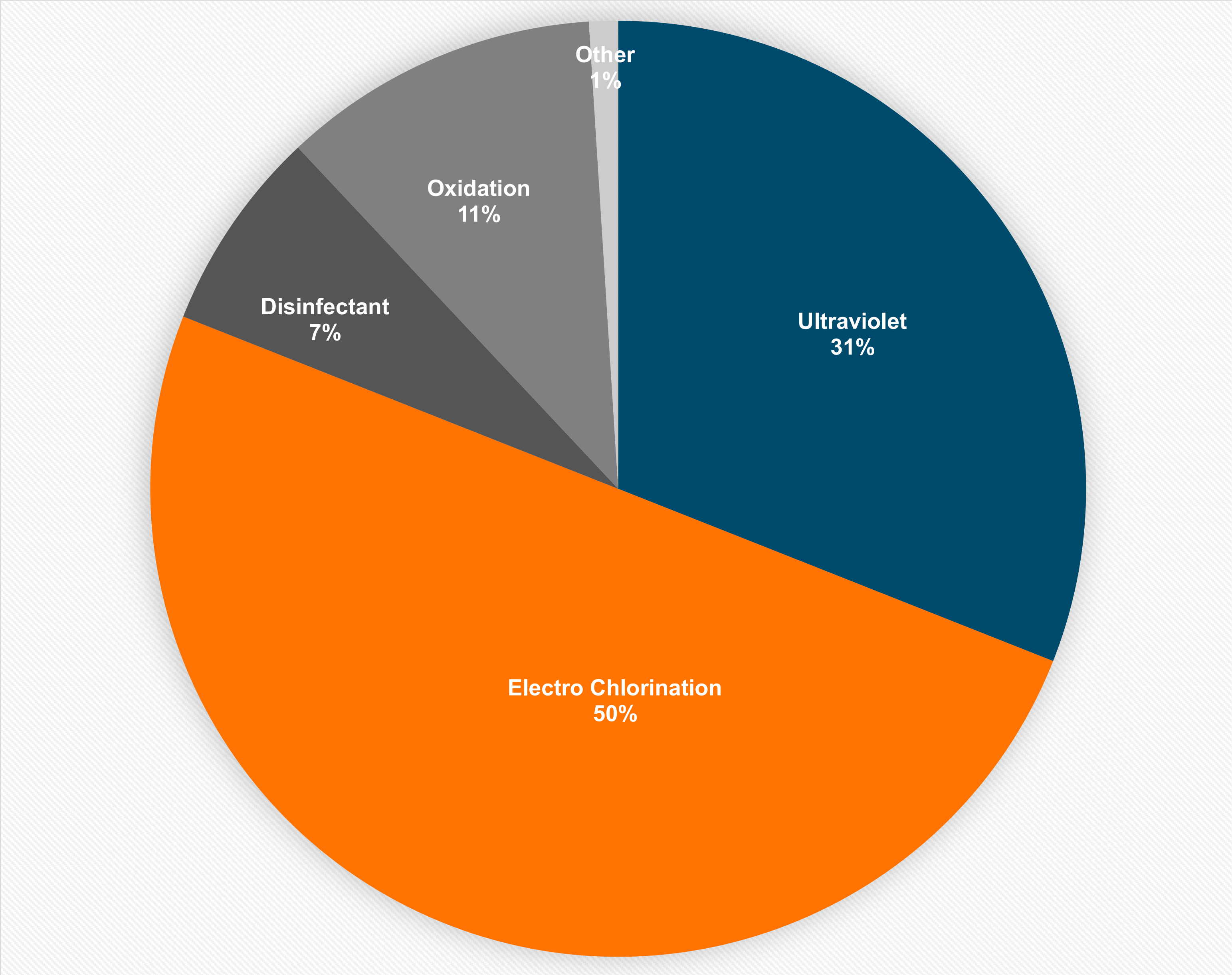


... no one-technology fits all (ship type, size operational profile etc.)

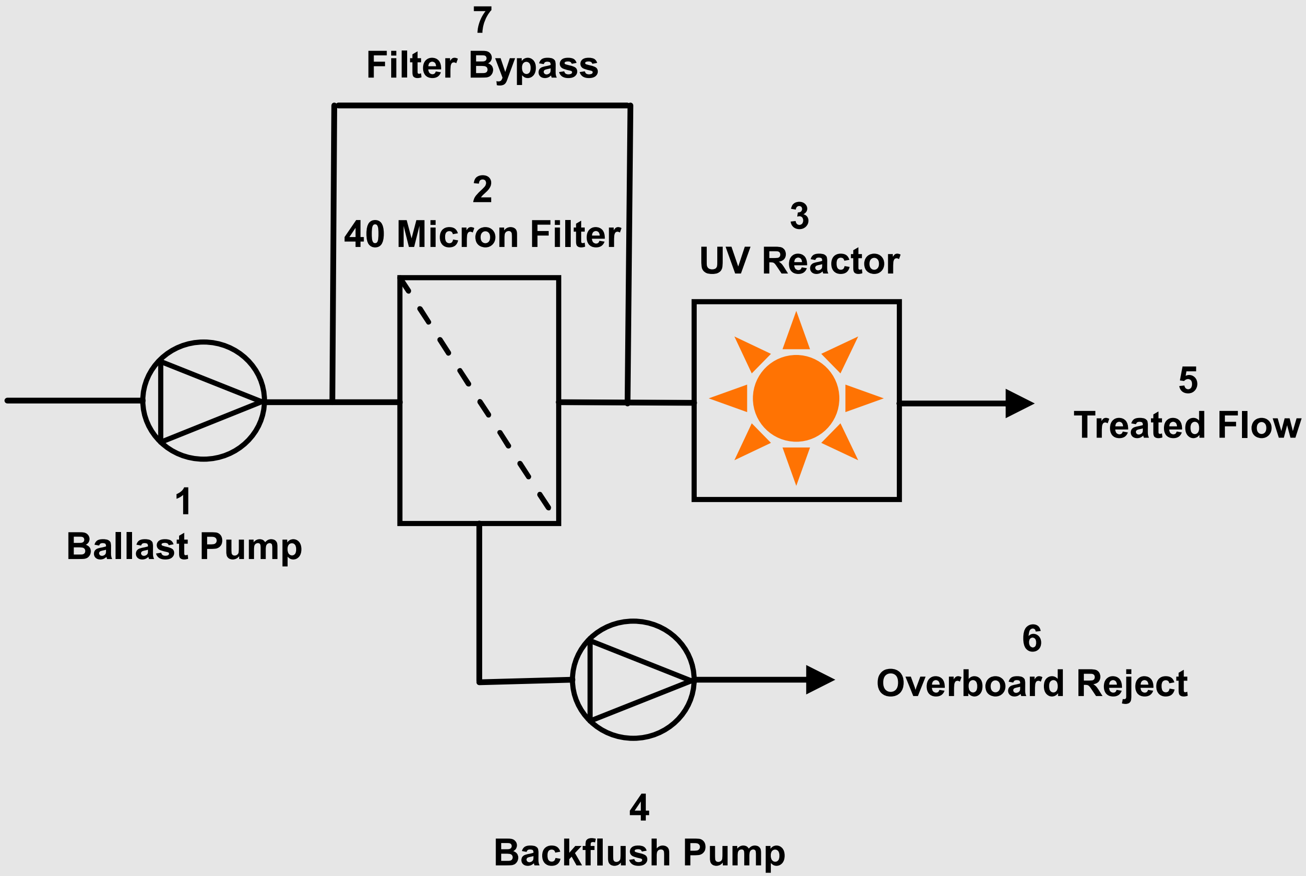
Flow capacity and pump rates

Vessel category	Vessel type	Pump rate (m^3/hr)	Ballast capacity, m3
	Bulk carriers		
High ballast dependent vessels	Handy	1300	18000
	Panamax	1800	35000
	Capasize	3000	65000
	Tankers		
	Handy	1100	6500
	Aframax	2500	31000
	Suezmax	3125	54000
	VLCC	5000	90000
	ULCC	5800	95000
Low ballast dependent vessels	**Containerships**		
	Feeder	250	3000
	Handy	400	8000
	Subpanamax	400	14000
	Panamax	500	17000
	Postpanamax	750	20000
	Other vessels		
	Chemical carriers	600	11000
	Passenger ships	250	3000
	General cargo	400	4500
	Ro/Ro	400	8000
	Combination vessels	400	7000

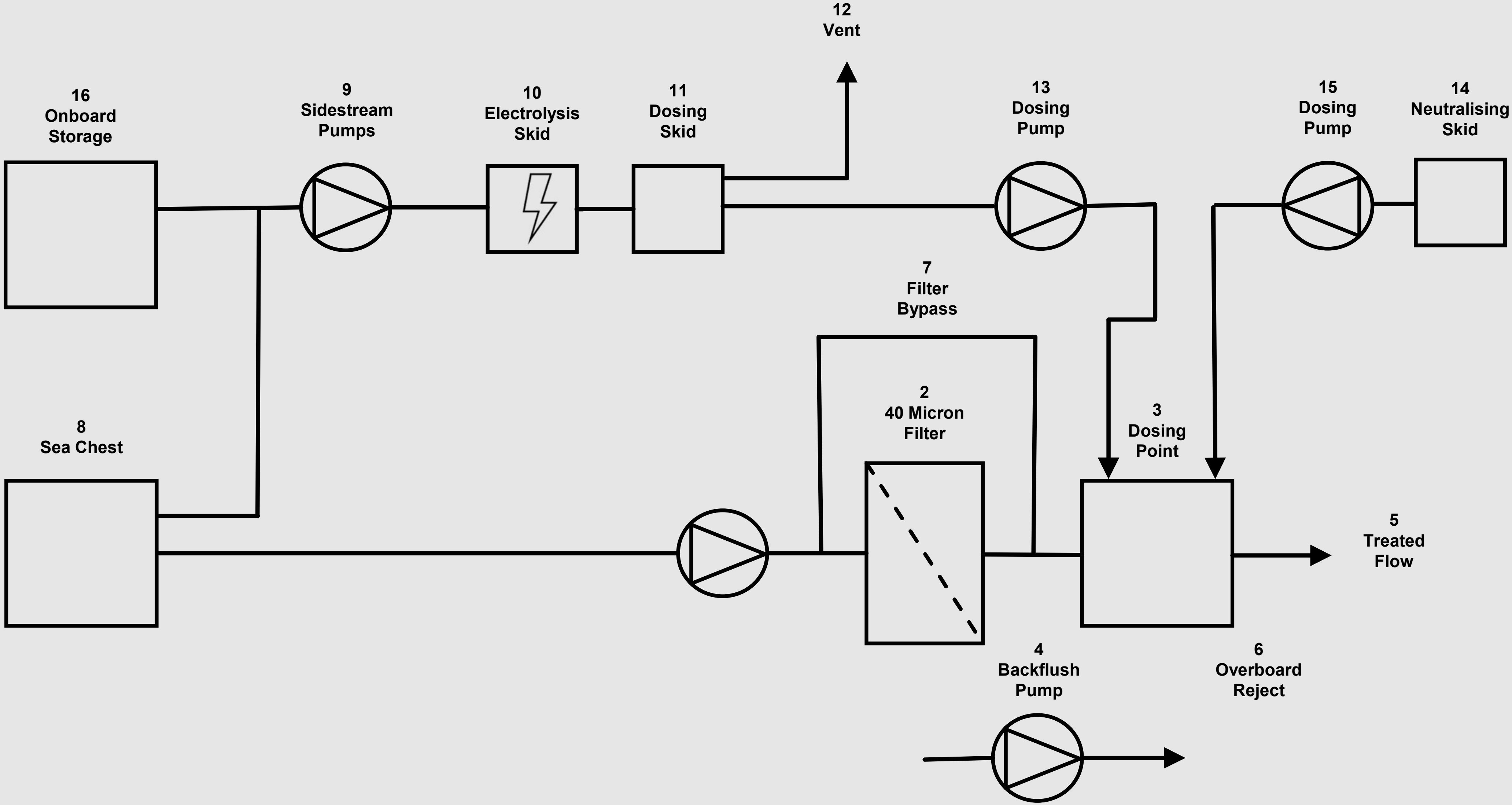
Major technologies



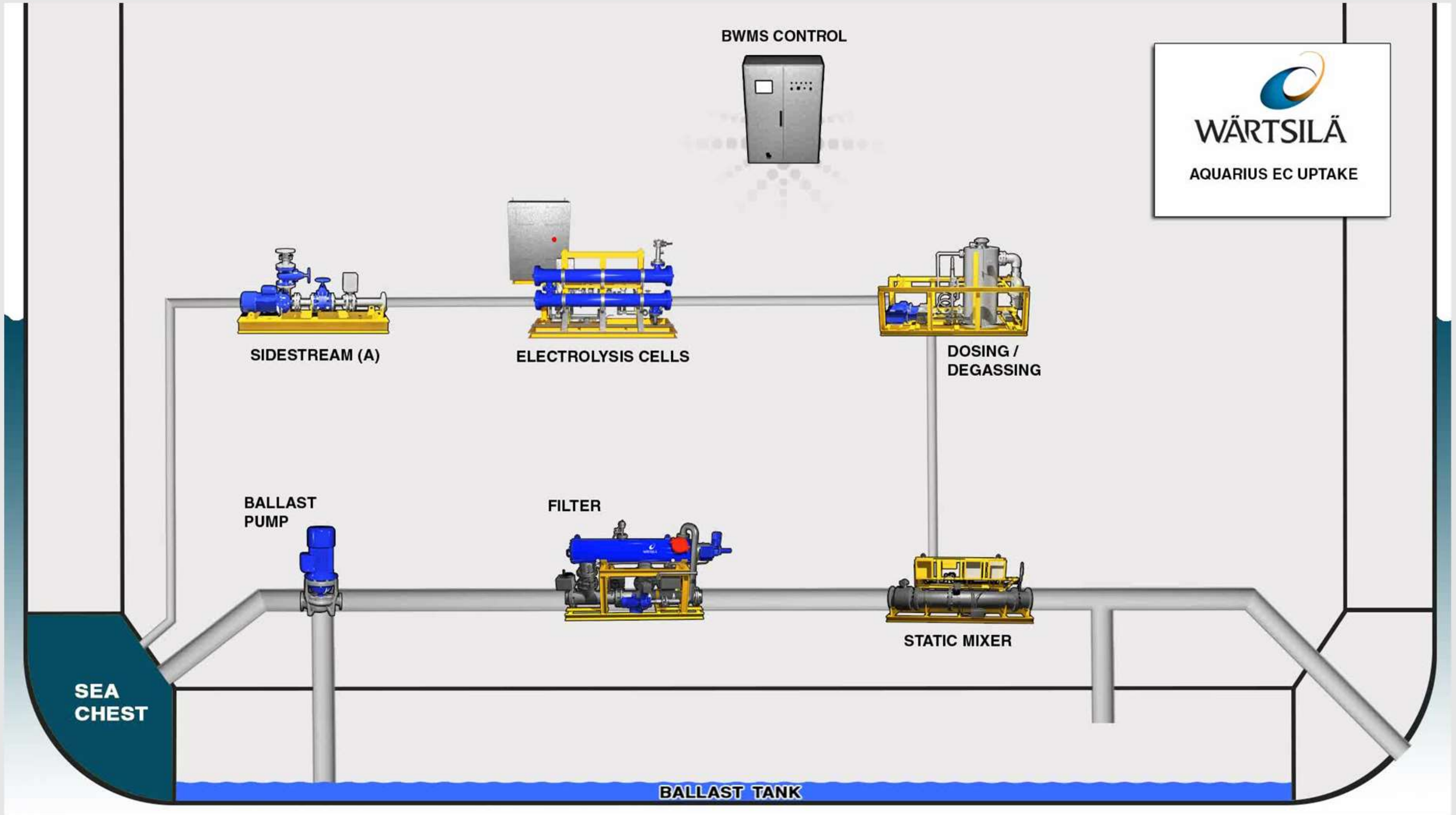
Working principle: UV



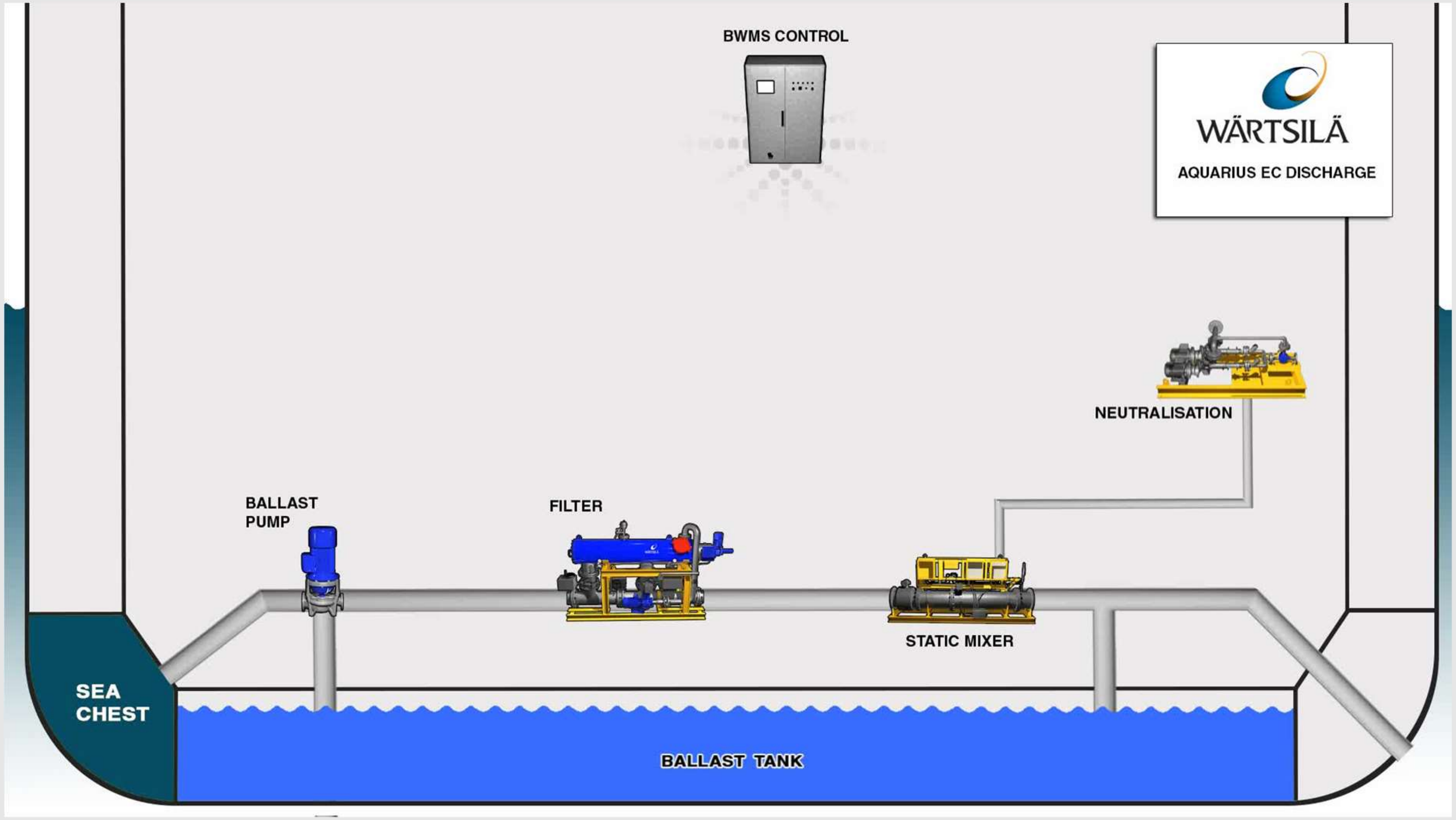
Working principle: EC



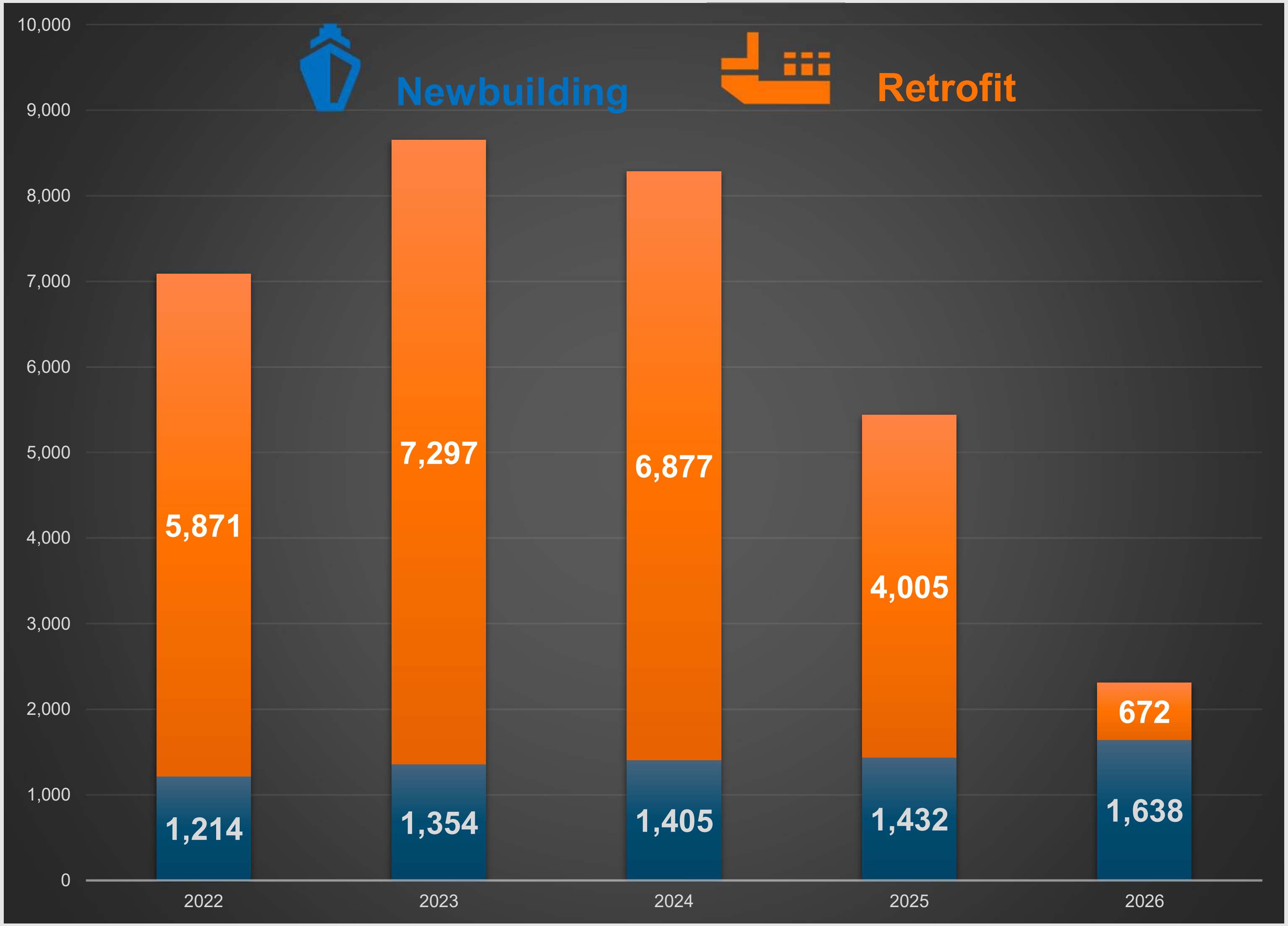
Ballast water uptake



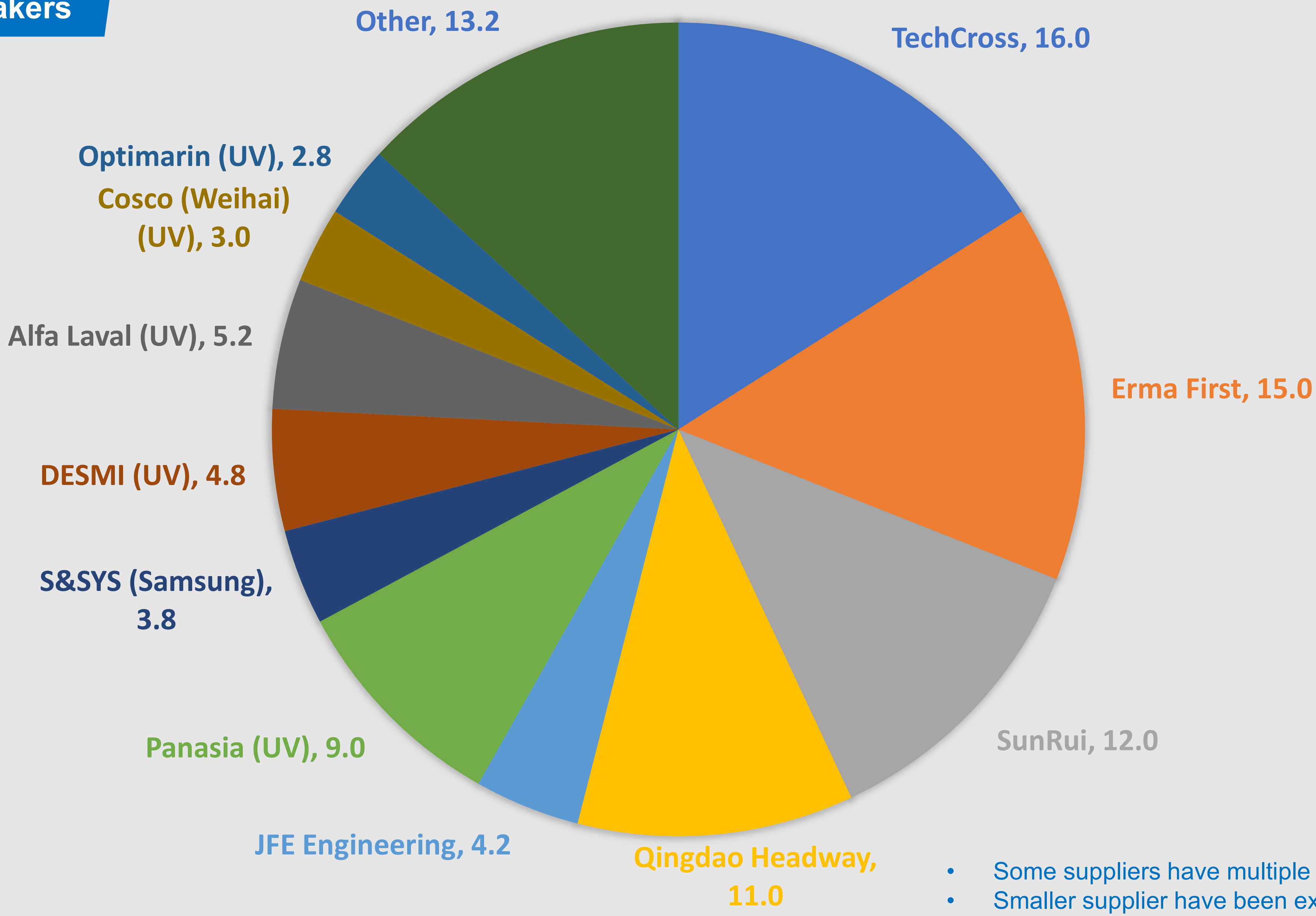
Ballast water discharge



Market: Newbuilding + Retrofits

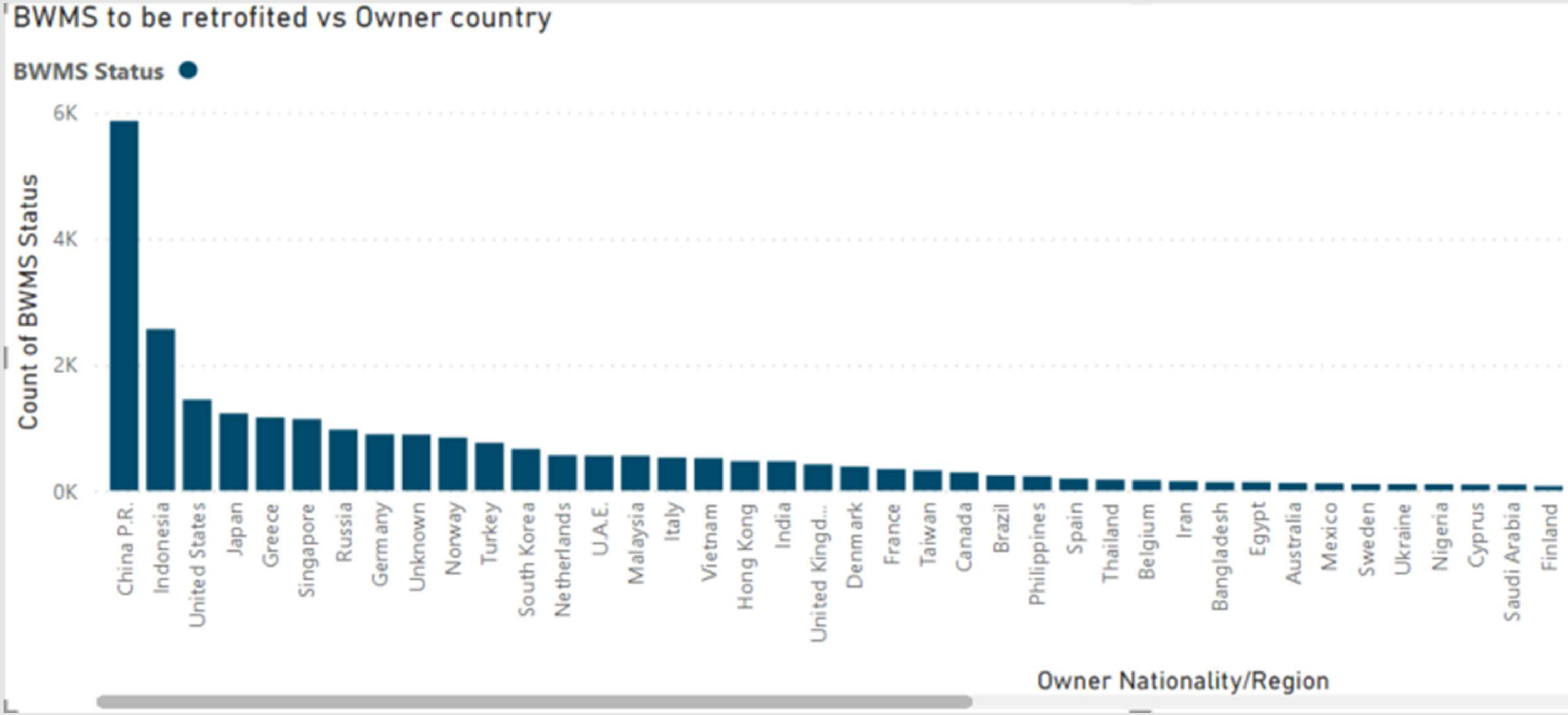


Major makers



- Some suppliers have multiple technologies
- Smaller supplier have been excluded from the list

Retrofit status



Selection criteria

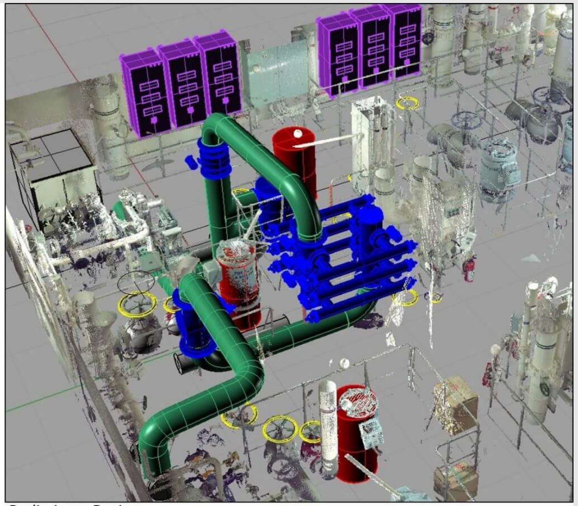
- Vessel type
- Maximum and minimum ballasting/deballasting rates and ballast cycle times
- The time required for taking on and discharging ballast water affects cargo operations,
- Ventilation requirements
- Space required (footprint and volume)
- Flexibility in placing system components and the need for structural changes
- Effects of pressure drop
- Ex certification requirements
- Ability to comply in specific ports along sailing routes
- Power availability and consumption
- Health and safety
- Effects on tank structure/coatings
- Ease of operation and integration with existing systems
- Other planned retrofits
- Additional training needs and crew workload
- Certificates
- System availability and delivery times
- Availability of consumables, spares, technical support and optimization services

Retrofit responsibilities

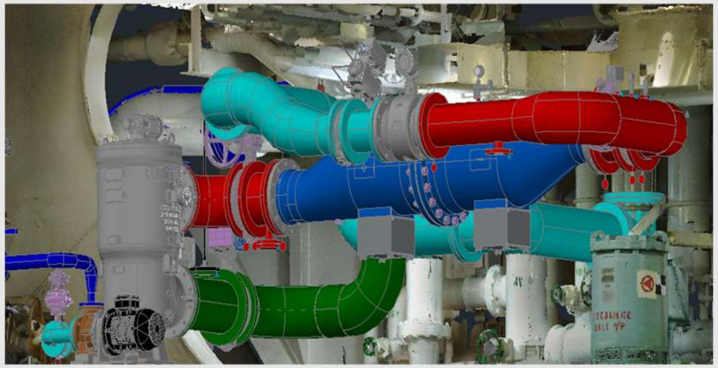
Equipment	3D Scanning	Basic + detail	Installation	Installation Supervision	Commissioning Sampling	Ballast Water: Management Plan & Certificate
MAKER	**MAKER**	**MAKER**		**MAKER**		
	OR	OR				
	CUSTOMER	**CUSTOMER**	**CUSTOMER**		**CUSTOMER**	**CUSTOMER**

Retrofit phases

1. 3D laser scanning +/- 2mm
2. 3D model of the engine room
3. Preliminary design + integration
4. Review & Appoval
5. Detailed engineeing
6. Pipe prefabication
7. Installation



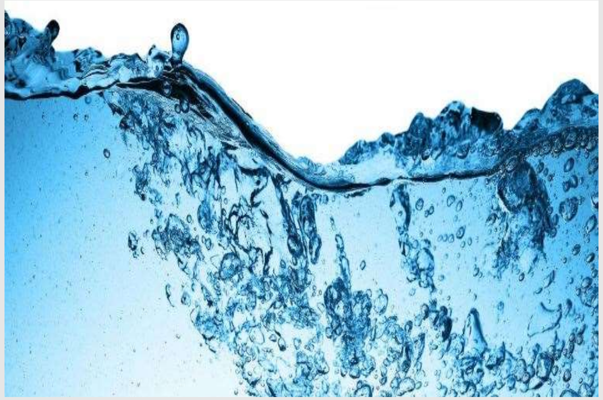
Preliminary Design



Alternatives?

Ballast Water Treatment Boat

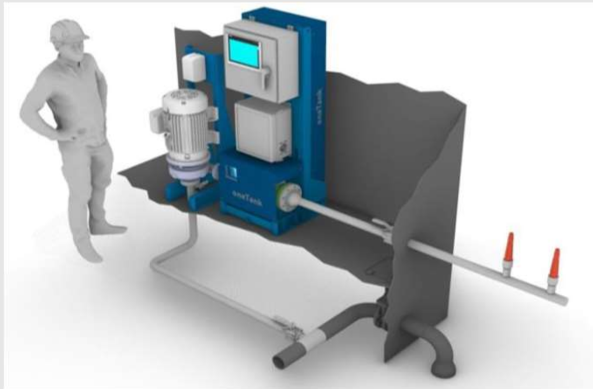
Onshore fresh water or
municipal waste-water treatment



Fresh water as ballast water

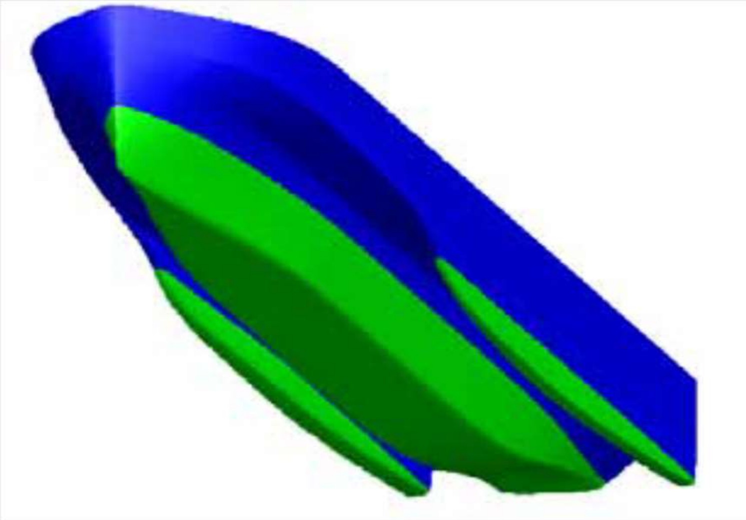
Reusing ballast water
through desalination by reverse osmosis

Mobile treatment unit onboard

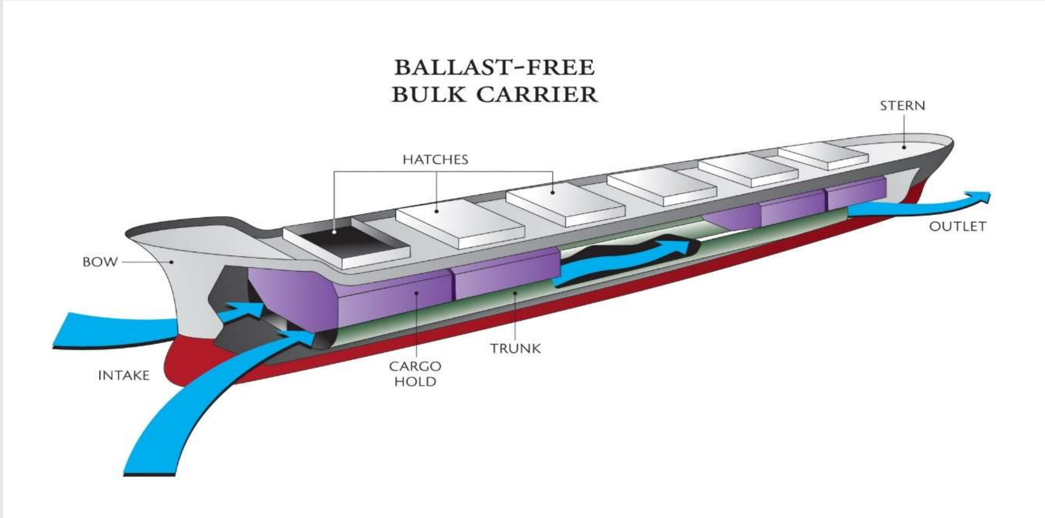


Ballast water treatment in-tank

New concepts in ship design



Cathedral hull form concept by DNV
for zero ballast 'high volume cargo' ships



General schematic of the longitudinal trunk concept


SAVE BLUE OCEANS!
THANKS!