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International Convention for the Control and Management of Ships' Ballast Water and Sediments

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A Ship Owner's Perspective

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Decision Factors

- Vessel Type
- Total ballast and maximum rated pump capacities (m^3/hr)
- Pump and piping considerations
- Likely trading pattern
- Engine room/pump room arrangement & electrical supply
- System flexibility and arrangement requirements
- Intrinsically safe (determined by vessel type and lay out)
- Dry dock or in-service fit
- Impact on tanks and paint work
- System operation and through life maintenance
- Crew training and familiarisation
- Supply of consumables and availability of approved servicing agents

- Ultimately:- which systems, suit which ships?

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Systems

Physical solid-liquid separation

Treatment:
- Hydrocyclone
- Surface filtration

Chemical enhancement:
- Coagulation/ Flocculation

Disinfection

Chemical treatment:
- Chlorination
- Electrochlorination or electrolysis
- Ozonation
- Peracetic acid
- SeaKleen
- Chlorine dioxide

Residual control:
- Chemical reduction (sulphite/bisulphite)

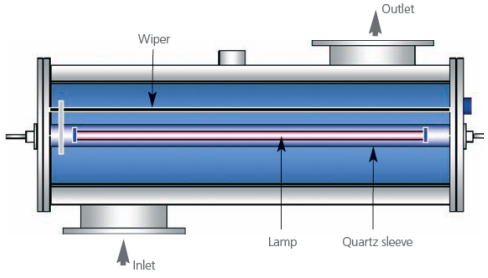
Physical enhancement:
- Ultrasonic treatment
- Cavitation

OR

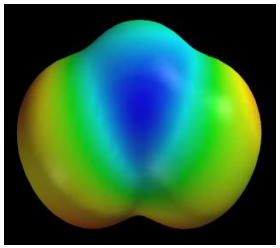
Physical
- UV irradiation
- UV + TiO_2
- Deoxygenation
- Gas injection
- Ultrasonic treatment
- Cavitation

Inert Gas

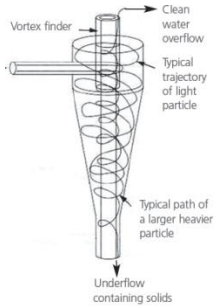
Chemical



Ultra violet (UV)



Ozone (O_3)



Filtration

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Case Study 1 - Filtration/Cavitation/Ozone

Vessel Type - Cape (211,000 DWT), total ballast capacity: 101,454.7m^3

- Pumps: x2/3,200m^3/hr centrifugal electric (located in E/R)
- 2 Filters required (one per pump) - 4.5m/1.5m dia. => large space requirements
- Cavitation system can be split and arranged either in a loop or horizontally
- Ozone generator must be located within 20m of cavitation loop
- Operational considerations:

  + Vessel draft in ballast condition

  + Engine room access and overhead clearance for filters

  + Back pressure increase on ballast pumps

  + Electrical supply will require additional 440V to 220V transformer

  + Ballasting of aft peak

  + Gravity ballasting not an option as minimum flow rate required for cavitation

  - If feasible work to go ahead during dry docking

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Case Study 2 - Filtration/Electrolysis/Chemical

Vessel Type - Cape (180,000 DWT), total ballast capacity: 78,392m^3

- Pumps: x2/2,500m^3/hr centrifugal electric (located in E/R)
- 2 Filters required (one per pump) => large space requirements
- Electrolysis unit can be located in convenient location
- Hydrogen generation (requires blower and dilution)
- Operational considerations:
    + Hydrogen control
    + Neutralising agents required on discharge (supply and storage)
    + Crew safety when handling chemicals
    + System allows easy ballasting of aft peak
- Possibility to carry out in-service installation being reviewed

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New Build:

- Integrated into ship from design stage
- Greater optimisation
- May result in shipyard specified system (how do we know this is the best option?)
- More pressure to install now

Retrofit:

- Each project will be different & require specific solutions
- Easiest when completed during a docking period
- More flexibility on system selection
- Time period available for other systems to come to market

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Pros & Cons

Equipments	Good points	Bad points	Cost basis on 2 x 2,500 M3/hr	
			Approx. Price	kW
Filter + UV system	* environmental friendly (no 2nd pollution) * simple system and easy automation * crew and ship safety	* u.s.a rule : not confirmed * ttl processing and UV equipments are too many * high power consumption * Exposion proof space to install	usd 2,000,000	950
			Euro 1,960,000	1,200
			usd 1,740,000	800
Deoxygenation	* environmental friendly (no 2nd pollution) * high protection of corrosion in ballast tanks	too many equipments and expensive	euro 2,000,000	593
		IMO D2, USCG rule - not confirm	usd 1,417,000	abt 220
Ozone injection	* high sterilization * low power consumption	* carcinogenic substance(bromate) * serious corrosion in ballast tanks * crew and ship safey problems	?	?
			usd 1,700,000	322
Electrolysis	* high sterilization * low power consumption * side stream * Skid package supply * simple installation at any place	* substance Cl2, H2 gas * crew and ship safey problems * marine pollution problems + neutralization and then deballast * performance down in fresh water * explosion proof space to install	usd 1,250,000	200
			?	?
			?	?
			?	?
			usd 1,549,000	367
Chemical (chlorite)	* high sterilization (ClO2, Peracetate)	* chemical tank and supply	?	?
		* chemical dangerous	?	?
		* Sulphuric acid + Purate required		

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Possible Problems for Owners - 1

- System type approval carried out at 1 temperature and 3 salinity's, will they function in real world conditions? How do owners know whether the system is operating as per approval?
- The Convention doesn't allow any Exemptions - if the installed system breaks down it must be repaired prior to operations continuing to the satisfaction of PSC
- Unknown costs (consumables/additional electric power/maintenance etc)
- Availability of spares and consumables
- Disposal of consumables and used equipment
- Installation process (in service or dry dock), tank cleanliness and costs for sediment disposal if required
- Water samples being rejected after the vessel has sailed (banned from entering port in the future)
- Uptake water quality and impact on system
- River passages with mud accumulation and removal

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Possible Problems for Owners - 2

- Water sample fails during loading/discharge operation and ballast water cannot be discharged as treated on up-take - how to proceed?
- Consequences of heated cargo tanks adjacent to treated ballast tanks
- Additional pressure (and training) for the crew
- Guidance from IMO currently unclear and open to “interpretation” by local PSC
- Concerns regarding various operational regions

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Questions?