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

A Ship Owner’s Perspective

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Contents

- Decision Factors
  - Systems
- Case Studies
- New Build/Retrofit
  - Pros & Cons
- Possible Problems for Owners
  - Questions?
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?
Systems

Physical solid-liquid separation

- Hydrocyclone
- Surface filtration

Chemical enhancement:
- Coagulation/ Flocculation

Disinfection

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

Residual control:
- Chemical reduction (sulphite/bisulphite)

Physical enhancement:
- Ultrasonic treatment
- Cavitation

OR

Physical:
- UV irradiation
- UV + TiO₂
- Deoxygenation
- Gas injection
- Ultrasonic treatment
- Cavitation

Inert Gas

Chemical

Filtration

Ultra violet (UV)

Ozone (O₃)
Case Study 1 - Filtration/Cavitation/Ozone

Vessel Type - Cape (211,000 DWT), total ballast capacity: 101,454.7m³

- Pumps: x2/3,200m³/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
Case Study 2 - Filtration/Electrolysis/Chemical

Vessel Type - Cape (180,000 DWT), total ballast capacity: 78,392 m³

- Pumps: x2/2,500 m³/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
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
## Pros & Cons

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