

Ballast Water Management Options

- **Port Based:** treatment performed at a land based facility, similar to wastewater treatment
- **Vessel Based:** treatment performed on board vessels, either behavioral or technological intervention
 - **Ballast Water Exchange**
 - *Flow Through:* replacement water is pumped into the ballast tank allowing the water to overflow, must be repeated to be effective
 - *Sequential:* ballast tank is emptied and refilled, typically require 3 exchanges
 - **Onboard Treatment**
 - *Primary*
 - *Filtration:* uses a filter system to strain out organisms, efficiency varies by screen diameter (in microns)
 - *Cyclonic:* use cyclonic activity to separate out organisms
 - *Secondary*
 - *Mechanical:* technological intervention to kill organisms
 - *Ultraviolet:* use of UV light to kill organisms, requires pre-filtration and is ineffective for certain organisms (cyst stages)
 - *Heat:* uses heat from the ship (or another source) to heat the water in the tanks to temperatures that would kill organisms
 - *Ultrasound:* specific frequencies used to kill organisms
 - *Magnetic Field:* magnetic fields have been utilized to kill invertebrates in laboratory studies
 - *Electrical Field:* electric pulses are sent through ballast water which kill most organisms
 - *Chemical:* addition of chemicals to ballast water to kill organisms
 - *Biocides:* a chemical such as bleach that kills organisms
 - *Chlorine:* oxidizing chemical that destroys cell membranes to kill organisms
 - *Ozonation:* very powerful oxidizing agent, chemical that destroys cell membranes through oxidation
 - *Hydrogen Peroxide:* addition forces an increase in pH which creates an unsuitable environment for many organisms
 - *Organic Chemicals:* application of chemicals to kill organisms