DESMI Ocean Guard A/S
- ballast water treatment systems

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BALLAST WATER TREATMENT – NAVIGATING UN-CHARTED WATERS

Ecotankers conference, Jan 22, 2015

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Agenda

- The Ballast Water Issue
  - Problem
  - Legislation
- DESMI Ocean Guard A/S
  - Background
  - Our OxyClean™ and RayClean™ systems
- Shipowner navigating un-charted waters
  - Uncertainties
  - Pitfalls
  - What to do?

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THE BALLAST WATER ISSUE

Ships carry ballast water around the world…

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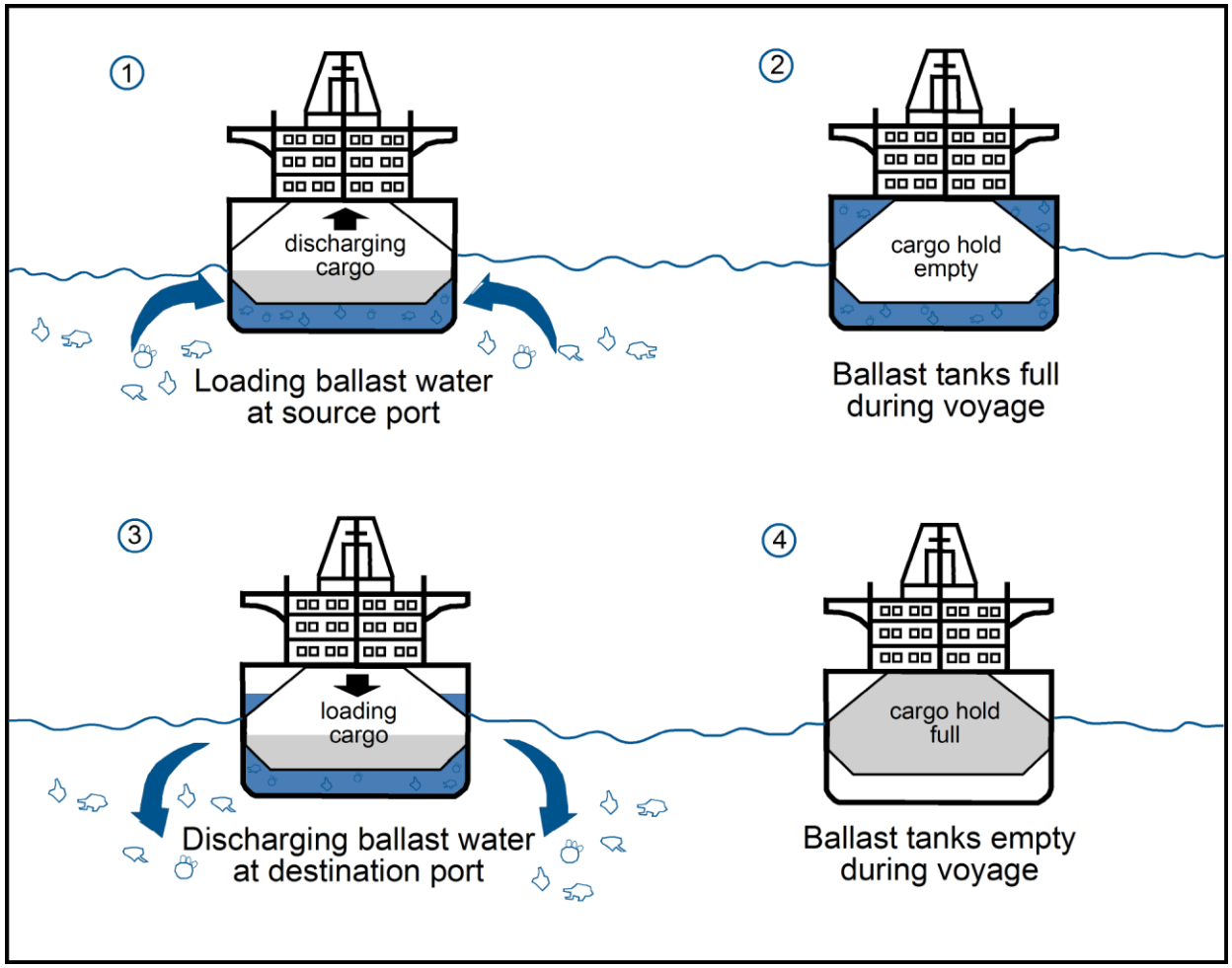

...and that causes problems!

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Zebra mussles in the Great Lakes

- Originate from the Black Sea.
- Found in Lake St. Claire in 1988.
- Has since spread to major parts of the inland US waterways
- Clogging of pipes of power plants and various industrial installations is estimated to cost the US society $ 200 mill. annually (in year 2000).

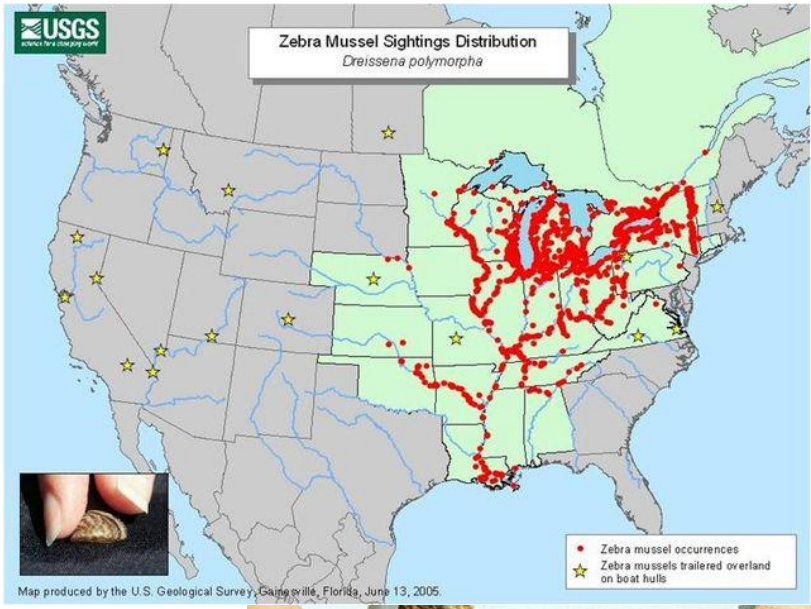

TABLE 2—ESTIMATED ANNUAL COSTS ASSOCIATED WITH AQUATIC NIS INTRODUCTION IN THE UNITED STATES
[$ in 2007]

Species	Costs
Fish	$5.7 billion.
Zebra and Quagga Mussels	$1.06 billion.
Asiatic Clam	$1.06 billion.
Aquatic Weeds	$117 million.
Green Crab	$47 million.

Global estimates today:

- **100 BUSD** annual cost (fishing, industry, tourism etc.)
- Risks of poisoning and epidemic diseases (Collera in Peru)

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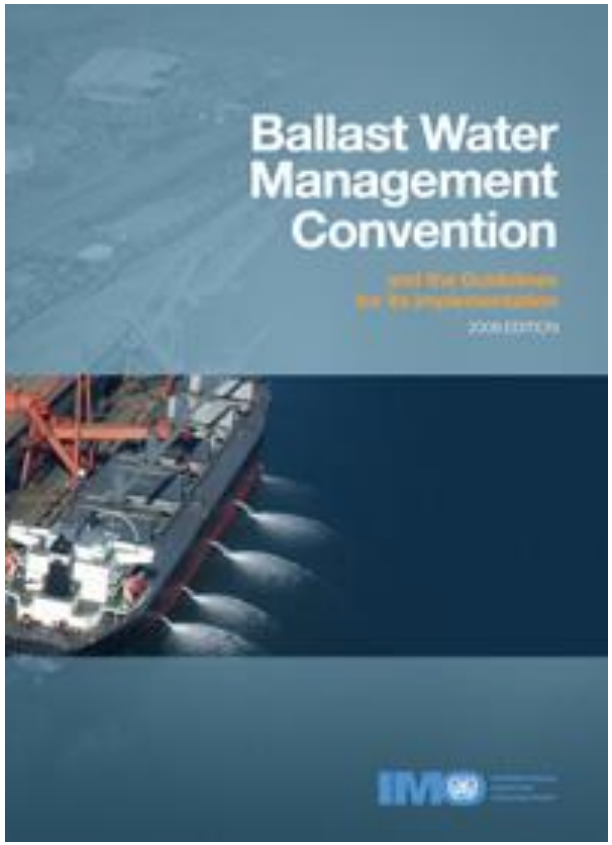
The beginning:

- Australia expresses concern in late 1980s
- Seeks understanding from the shipbuilding industry
- Wants e.g. ”clean” ballast tanks with heating coils
- More countries follow: Canada, Israel, Peru, Chile,...



IMO

- First report to IMO on the problem in 1988.
- Several guidelines on BW *exchange* (not treatment) was developed over the next 15 years.

- **In 2004 IMO adopts the BWM Convention**

…But still today the convention has not yet been ratified

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- Convention becomes effective 12 months after ratification

Ratification:
•30 countries, 35% tonnage

Status January 6'th, 2015:
•43 countries, 32,54% tonnage

LATEST IMO INFO:
"Italy, Turkey, Argentina and Japan have all declared that they will ratify before the end of 2014 which will bring the total to 34.20 % of the world fleet. Indonesia, Philippines, Belgium and Finland (with over 2% of the world fleet between them) have confirmed that their ratification process is on its way."

- Several guidelines for the implementation are being finalized or reviewed:
  - G8 guideline for how to test systems is under review
  - Guidelines for sampling and port state control are being finalized

- It is widely expected the convention will be ratified during first half 2015

USCG Final Rule entered into force 22'nd June 2012

- Adopts IMO Discharge standards (D2)
- Adopts IMO timeline from Dec 1'st 2013 and onwards

Regulation	Requirement
Jurisdiction	U.S. territorial sea – 12 nautical miles
Applicability	Sea-going vessels previously required to conduct BWE and coastwise vessels that do not operate outside EEZ but are greater than 1,600 GT and transit between Captain of the Port Zones
Implementation Schedule *Dates are January 1 unless specified* *(First regularly scheduled drydocking after a vessel's compliance date)*	New Vessels (Dec 1, 2013 keel laying): On delivery Existing Vessels (BW capacity in cubic meters): <1,500: 2016 1,500 - 5,000: 2014 >5,000: 2016
Great Lakes	Applies to vessels that depart the Great Lakes, transit beyond the EEZ, return and pass upstream of Snell Lock, aka "Salties."

- New ships keel laid on or after Dec. 1, 2013 should today have USCG type approved BWTS onboard when calling US ports.
- Existing vessels with BW capacity between 1500 and 5000 m3 should install USCG type approved BWTS at their first scheduled drydocking.

…but there are no USCG type approved systems today. Therefore exemptions are being issued to ship owners

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- USCG does **not** accept BWTS type approvals issued by foreign administrations
- Adopts ETV protocol for testing of BWTS – main differences:

	USCG	IMO
Landbased tests:	Test in all water salinities for which system should be approved: fresh, brackish, salt	Test in two water salinities and system will be approved for all salinities
	5 consequtive tests in each water salinity	5 tests in two water salinities
	Endurance testing: 10.000 m^3	No endurance testing
	Tests must be conducted at USCG approved test centres (Independent Laboratories)	Tests must be conducted at facilities approved by a member state
	System must be operated by testcentre personnel	System can be operated by system developers own personnel
Shipboard tests:	5 consequtive tests with min. 6 months between first and last	3 consequtive tests with min. 6 months between first and last
	System must be operated by ship's crew	System may be operated by system developers own personnel

- No systems have been USCG type approved to date.
- USCG issue exemption letters to vessels that should have been equipped with BWTS.
- Ships with a AMS accepted system installed are allowed to use the system in US waters

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Comparison: AMS vs Type Approval

- ✓ **AMS and U.S. type approval are separate programs.**
- ✓ **AMS acceptance**
  - Does NOT guarantee U.S. type approval.
  - Does NOT directly assist in obtaining U.S. type approval.
  - Is NOT required for U.S. type approval.

What is AMS acceptance?

- A temporary acceptance allowing the use of foreign state type approved systems to be used in US waters.

Response to Rumors

- Coast Guard is NOT changing any Implementation Dates contained in the Final Rule
- Coast Guard is NOT removing any systems from AMS Acceptance List
- Coast Guard does NOT have preference for any type of treatment system technology
- Coast Guard does NOT need ETV shipboard testing protocols to Type Approve Ballast Water Treatment Systems
- Coast Guard will NOT wait to issue a type approval certificate if an application demonstrates that all criteria for type approval has been met.

Legislative summary

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- IMO convention adopted in 2004, but not yet in force
- USCG final rule in force, but USCG type approved systems are not available

➢ **This results in no requirement for installation of BWTS today**

- We will be past 1 january 2016 before the IMO convention enters into force and there is a sufficient amount of available USCG type approved systems

➢ **Requirements for installation of BWTS will be introduced after 1st January 2016**

- This means that from one day to another we go from no installation requirements to a situation where:
  - All newbuilds must be fitted with BWTS on delivery
  - All existing vessels must retrofit within their next shceduled drydocking, i.e. within a 5 year window

➢ **We have created a huge bottleneck!**

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DESMI Ocean Guard

Company Background

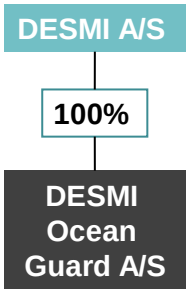
- combined areas of experience has formed the basis for development of world-class systems

Company Background

- Started as Joint Venture between DESMI, MAERSK and ULTRAAQUA in 2009
- Combining: knowledge of ship operation, water treatment in large scale, and supply of maritime equipment
- DESMI Ocean Guard has developed two Ballast Water Treatment Systems (BWTS):
  - OxyClean
  - RayClean

Current ownership

Today the company is wholly owned by DESMI A/S.



Locations

Main office: Aalborg, Denmark
Manufacturing: Aalborg, Denmark

Desmi Offices:
Denmark, Germany, Netherlands, Norway, UK, Singapore, USA, Indonesia, China, Korea, Ecuador, France, UAE, India

The DESMI Ocean Guard system - RayClean™

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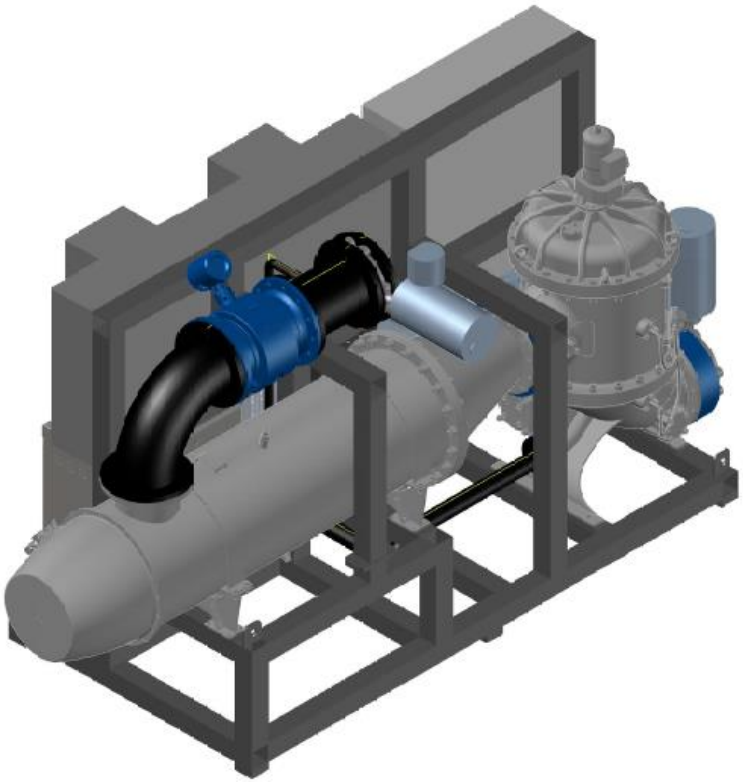
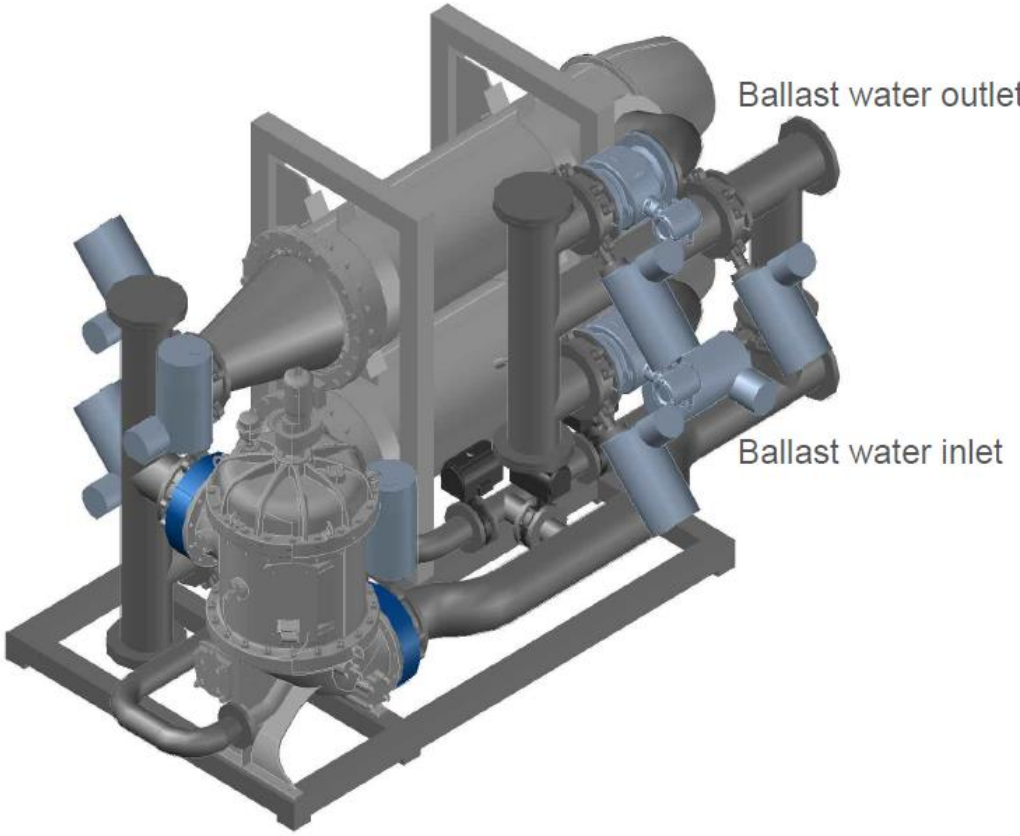


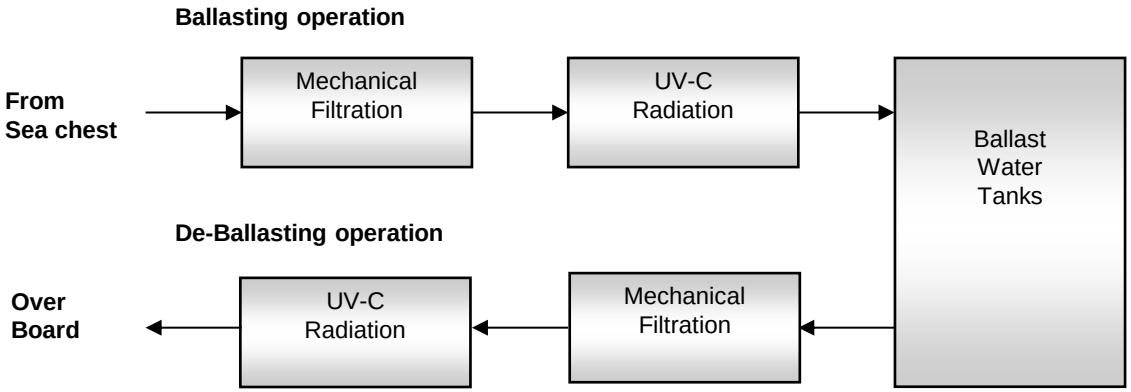
RayClean-300 (300 m3/h)



RayClean-600 (600 m3/h)

The DESMI Ocean Guard system - RayClean™

- Fully automatic adjustment to water quality
- Lowest power consumption in class
- Proven performance in extreme water with UV-T as low as 0,33
- No salinity limitations
- No temperature limitations
- Compact and modular design



RayClean™ approval status

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- *RayClean system has received IMO and DNV type approval in September 2014*

- All testing done according to both IMO G8 guideline and USCG ETV protocol
- Testing done with USCG accredited Independent Laboratory DNV, by its USCG approved sub-contractor DHI

- *RayClean system is in pole position for obtaining USCG type approval*

- We expect to be one of the very first to receive USCG type approval, but it is not known today when USCG will start issuing type approvals.

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NAVIGATING UN-CHARTED WATERS

Many concerns to address as shipowner

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DESMI recommendations

- How to comply with the rules?
  - Don’t discharge ballast water
  - Use drinking water as ballast water
  - Discharge to landbased reception facility
  - Treat ballast water with BWTS before discharge

To maintain operational flexibility treat with BWTS!
- Don’t discharge - not a possibility for most ships
- Use of drinking water is expensive, and infrastructure for amounts needed not in place
- Landbased reception facilities are rare

- When to comply?
  - Wait until official compliance date?
  - Install now to avoid retrofit rush and bottlenecks?

Start installations now!
- When retrofit rush starts your preferred maker may very well have extremely long delivery time
- There might be 40+ type approved systems on the market, but the majority of owners and yards wants to purchase from the same 5 to 10 makers

- Which treatment technology to use?
  - Capex vs. Opex
  - System and technology limitations?
  - Chemicals, no chemicals?
  - Logistical issues
  - Safety issues

- Consider Total Cost of Ownership
- Avoid salinity and temperature limitations!
- Avoid use of chemicals when possible
- Avoid consumables that are not readily available on the vessel today
- Avoid any use or generation of dangerous substances

Pitfalls!

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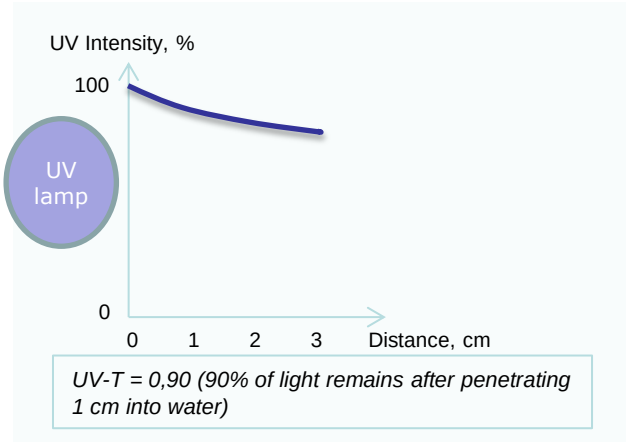
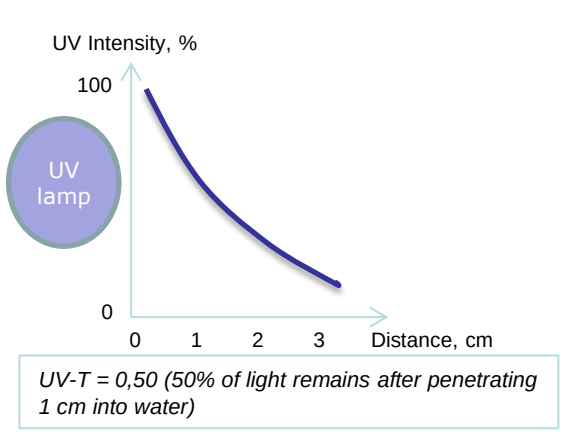
Don’t buy type approved systems that will not work in reality!

- All BWTS have limitations
- Know the limitations before you purchase!
- Typical limitations are related to:
  - Active substance systems: Salinity, Temperature
  - UV systems: UV-Transmission
- You need independent 3rd party documentation of the system limitations

Example: UV-Transmission limitation

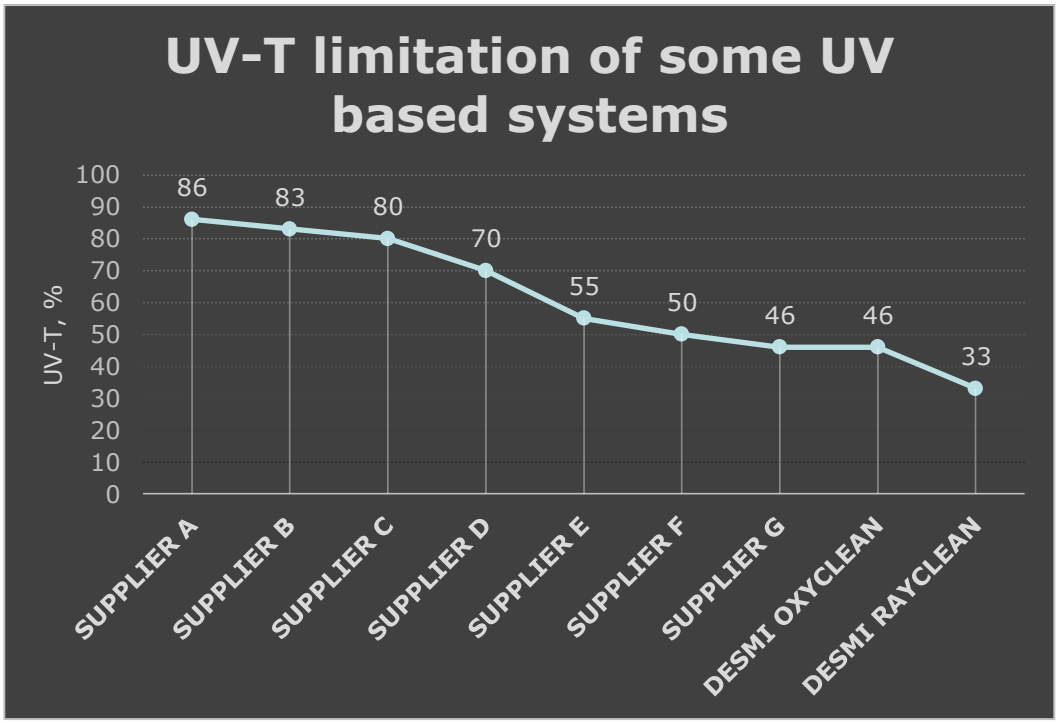


UV-T = 0,90 (90% of light remains after penetrating 1 cm into water)



UV-T = 0,50 (50% of light remains after penetrating 1 cm into water)

UV-Transmission – Systems limitations and real world requirements



Port	UV-T
Shanghai[i], China	49
Vera Cruz, Mexico	94
Houston, USA	74
New Orleans, USA	54
Shanghai[i], China	55
Hong Kong, China	80
Antwerp, Belgium	66
Rotterdam, Netherlands	93
Lisbon, Portugal	53

[i]*Measured at different dates and locations in Shanghai port.*

Conclusion

- The situation is highly complicated
- If you don’t want to end up as a loser, prepare now and start installation of systems.
- If you wait until everybody has to install you will experience extremely long delivery times and increased prices
- Carefully consider available technologies and systems
- Not all type approved system will work in real operation
- Not all type approved systems will be capable of receiving USCG type approval.