



Development Status of Ballast Water Management System

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2011-12-1



- **Ballast Water Management Convention**

- **Background**

- Ship ballast water carries aquatic organisms and pathogens, unlimited discharging of ballast water can cause serious ecological, economic and public health impact.
- IMO Convention for the Control and Management of Ships' Ballast Water and Sediments in 2004 required that all ships implement ballast water performance standards(D-2 standard) in accordance with the timetable.



D-2 standard

Organism Category	Regulation
Organisms, $\geq 50\mu\text{m}$ in minimum dimension	< 10 cells/ m^3
Organisms, $< 50\mu\text{m}$ and $\geq 10\mu\text{m}$ in minimum dimension	< 10 cells/ml
Toxicogenic <i>Vibrio cholerae</i> (serotypes O1 and O139)	$< 1\text{cfu}/100\text{ml}$, or $< 1\text{cfu}/\text{g}$ (wet weight) of plankton samples
<i>Escherichia coli</i>	< 250 cfu* /100mL
<i>Intestinal Enterococci</i>	< 100 cfu* /100mL

* cfu: cell form unit

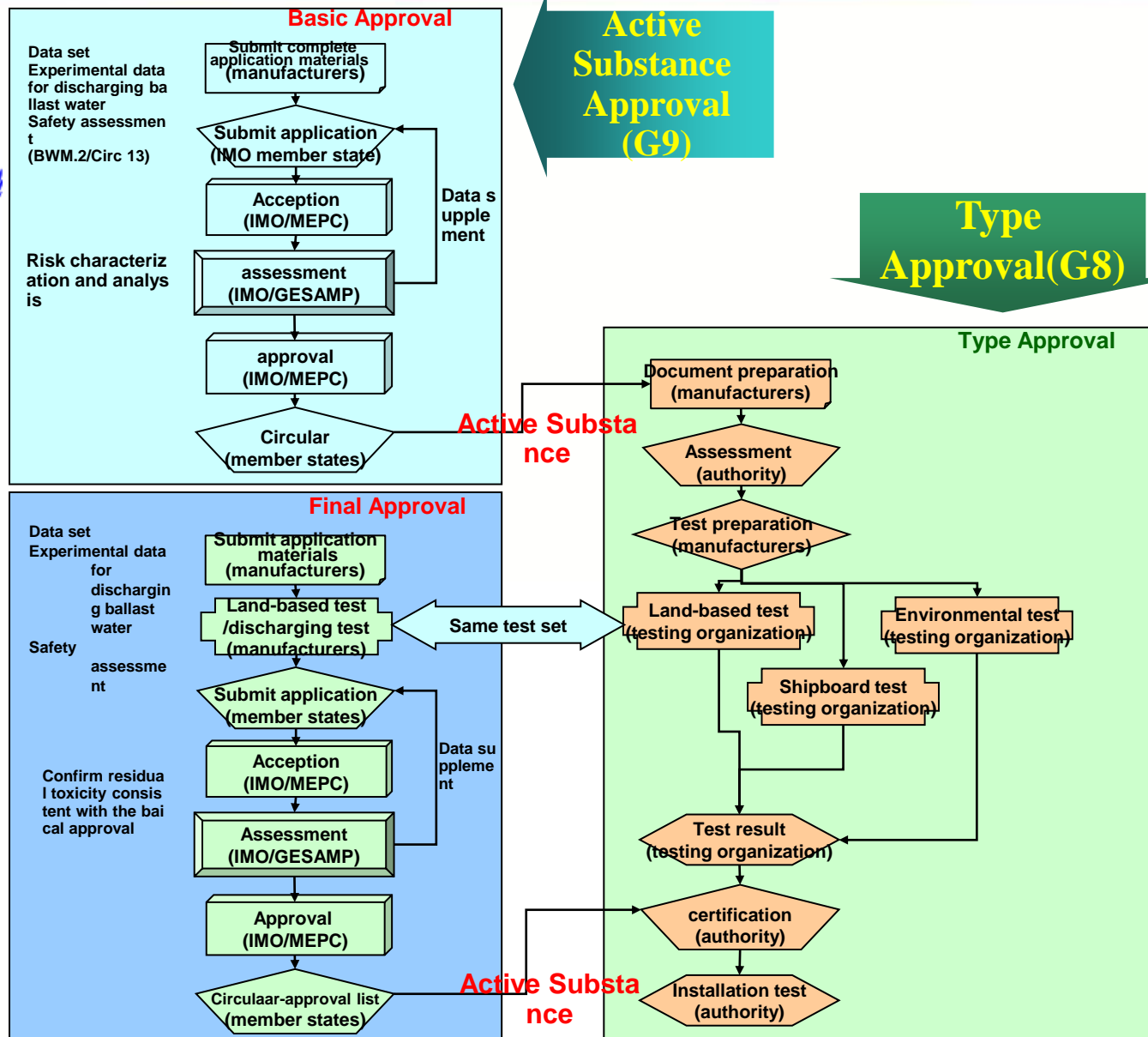


Time Table

Date of construction (year)	Ballast Water Capacity (m3)	Date of implementation of D-1 or D-2 standard	Date of mandatory implementation of D-2 standard
Before 2009	1500-5000	until 2014	by 2014
	< 1500 or > 5000	until 2016	by 2016
In or after 2009	< 5000		by 2009
In or after 2009, but before 2012	≥ 5000	until 2016	by 2016
In or after 2012	≥ 5000		by 2012



Procedure for approval of ballast water treatment system





- **Conditions for Entry-into-Force**

- **Conditions**

- **No less than 30% states ratified; and**
- **No less than 35% of the world total merchant shipping gross tonnage.**

The Convention will enter into force 12 months after the date on which the above conditions have met

- **Status of Ratification (by October 31, 2011)**

- **30 States;**
- **26.44% of the world total merchant shipping gross tonnage.**
- **The Convention will enter into force 12 months after the date on which the above conditions have met**



- **Development Status of BWMS**

- **Statistic**

- **60** manufacturers

- **67** kinds of Ballast Water Management Systems.

- **Status of Approval**

- **IMO Approved**

- 35** Basic Approval

- 18** Final Approval

- **Type Approved**

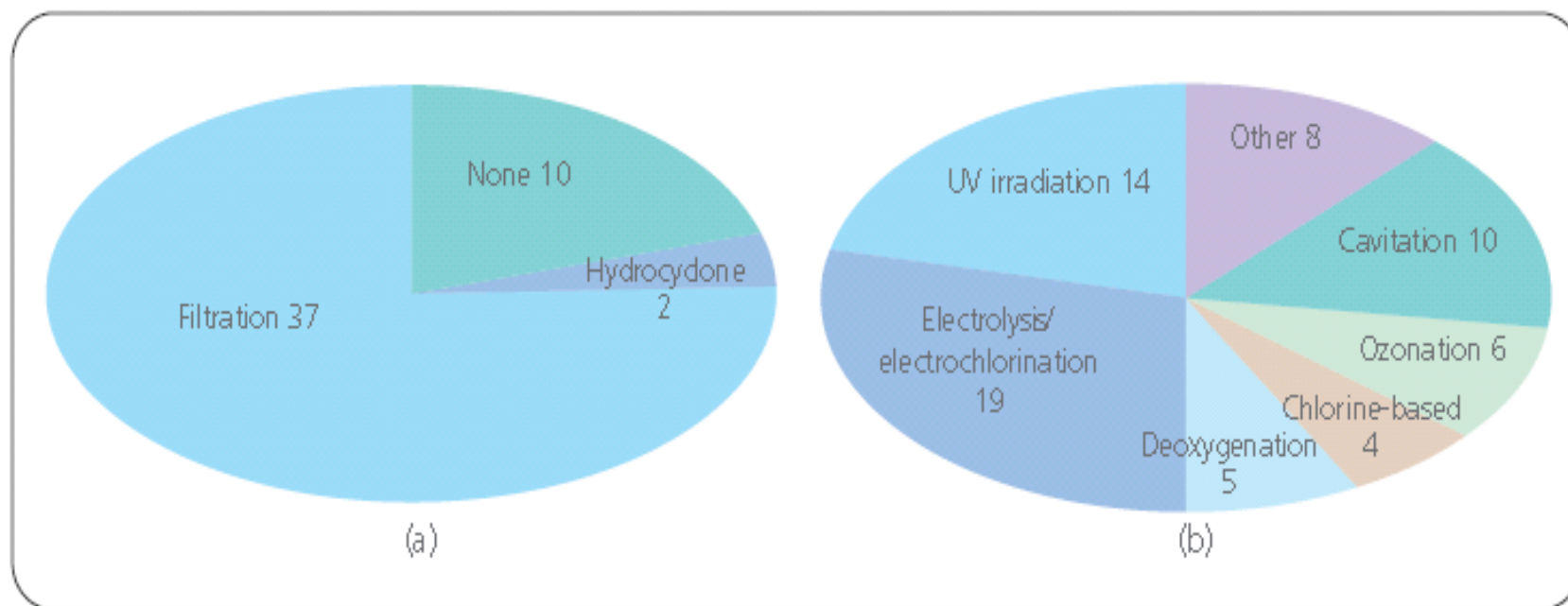
- 17** Type Approval



BWMS in China

No.	Manufacturer/ Country	System	Type Approval status	Techonology
1	SunRui Company/ China	BalClor™ BWMS	IMO FA, and TA by CCS	Filtration + Electrolysis + Neutralization
2	COSCO/ China	Blue Ocean Shield	TA by CCS	Filtration + UV
3	Headway/ China	OceanGuard	TA by CCS	Filtration + Electrolysis
4	Wuxi Brightsky/ China	BSKY™ BWMS	TA by CCS	Filtration + UV
5	Taixing /China	NiBallast BWMS	On-going TA by CCS	Ultrafiltration + Deoxygen
6	Nantong Haijing/China	Elite® BWMS	On-going TA by CCS	Filtration + UV + Ultrasound
7	Shanghai Marine Equipment Research Institute / China	—	On-going TA by CCS	Filtration + UV

Treatment Technologies Statistics



(a) Physical Pre-treatment Method

(b) Dis-infection Method

Dominant Technologies:

- Electrolysis method
- UV method



CHINA SHIPBUILDING
INDUSTRY CORPOATION

SunRui Marine Environment
Engineering Compay

THE YEARBOOK OF BALCLOR™ BWMS

BalClor™ BWMS年鉴



2007年7月，青岛双瑞防腐防污工程有限公司完成了第一台样机的设计制造

The prototype machine was completed in July 2007 by SUNRUI company.



2008年6月，青岛双瑞防腐防污工程有限公司建成国内第一套陆基实验设施

The first base testing for ballast water treatment had been completed in June 2008 in China.



2009年12月BalClor™ BWMS通过陆基实验型式认可

BalClor™ BWMS has been granted for Type approval of the land-based testing in December, 2009.



2010年10月，青岛双瑞公司的BalClor™ BWMS在第61次国际海事组织（IMO）大会上获得最终认可

BalClor™ BWMS has been granted for the Final approval in MEPC 61 meeting in October, 2010.



2011年1月28日，BalClor™ BWMS获得CCS型式认可

BalClor™ BWMS has been granted for type approval by CCS in January 28, 2011.

2007年

2008年

2009年

2010年

2011年



• Approval



INTERNATIONAL MARITIME ORGANIZATION

MEPC 61/WP.13
Page 7

MARINE ENVIRONMENT PROTECTION COMMITTEE
61st session
Agenda item 24

MEPC 61/WP.13
30 September 2010
Original: ENGLISH

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As at its date of issue, this document, in whole or in part, is subject to consideration by the IMO organ to which it has been submitted. Accordingly, its contents are subject to approval and amendment of a substantive and drafting nature, which may be agreed after that date.

DRAFT REPORT

1 INTRODUCTION

1.1 The sixty-first session of the Committee was held at IMO Headquarters in London, from 28 September to 2 October 2010, under the chairmanship of Mr. A. M. ...

1.2 The session was attended by delegations from the following Members of IMO:

ALGERIA	GERMANY
ANGOLA	GUINEA-BISSAU
ANTIGUA AND BARBUDA	HUNGARY
ARGENTINA	INDONESIA
AUSTRALIA	IRAN (ISLAMIC REPUBLIC OF)
AUSTRIA	IRELAND
BAHAMAS	ISRAEL
BANGLADESH	ITALY
BELGIUM	JAMAICA
BELIZE	JAPAN
BOLIVIA (PLURINATIONAL STATE OF)	KENYA
BRAZIL	LATVIA
BULGARIA	REPUBLIC OF KOREA
CANADA	
CHILE	
CHINA	
COLOMBIA	
COOK ISLANDS	
CÔTE D'IVOIRE	
CROATIA	
CUBA	
CYPRUS	
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	

1 Special Pipe Hybrid Ballast Water Management System combined with Ozone treatment version, proposed by Japan in document MEPC 61/2/2;

2 'ARA Ballast' Ballast Water Management System, proposed by the Republic of Korea in document MEPC 61/2/5;

3 BalClor Ballast Water Management System, proposed by China in document MEPC 61/2/4;

4 ...

BalClor Ballast Water Management System, proposed by China in document MEPC 61/2/4;

2.8 The Committee then invited the Administrations of China, Germany, Japan, Norway and the Republic of Korea to verify that all the recommendations made in the aforementioned reports (annexes 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 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- **BalClor™ System Operation Principle**

- **Filter:**

- Installation Purpose: Remove large size marine organisms or suspended particles with dimension over 50um, reducing total amount of solid materials.

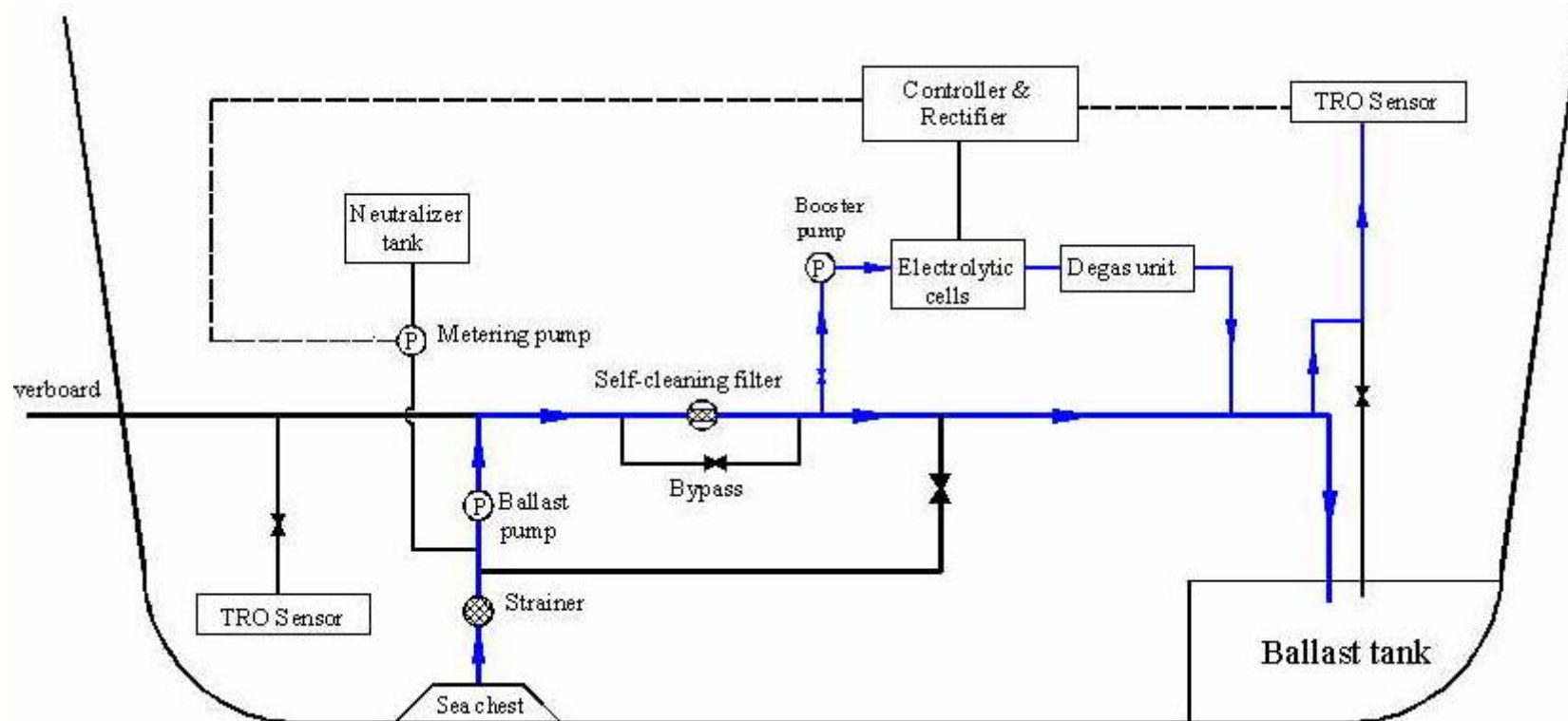
- **Electrolyzer:**

- Generate high concentrated Sodium Hypochlorite solution to effectively kill planktons, spores, pathogens, larvae, viruses and other marine organism.

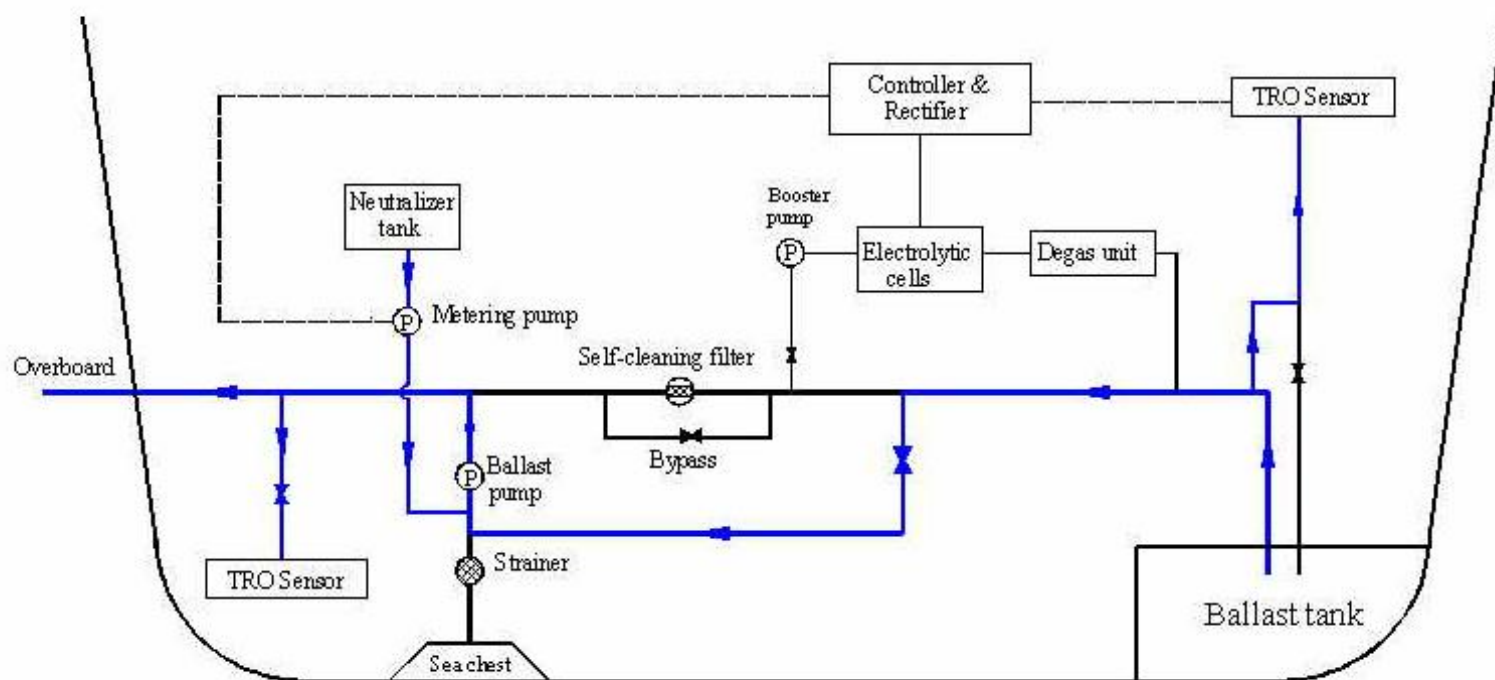
- **Neutralization:**

- Adding neutralization agent to main water pipe during de-ballasting process to neutralize TRO* in ballast water, in order to meet D-2 discharging regulation.
- *TRO: total residual oxidant.

Ballasting



De-ballasting





- **Safety Assessment of BalClor™ BWMS**

- **ES**

- Chemical Analysis & Environment Protection**

- Aquatic Organism Toxicity Test**

- **HS**

- All Personnel**

- Exposure Scenario**

- **VS**

- Corrosion**

- Hydrogen Safety**



- ## Environment Safety

According to IMO requirements, third-party testing organizations who has the qualification (ISO17025), was commissioned to evaluate the environmental safety:

1	Chemical analysis: no persistence, no bioaccumulation, no toxicity, namely no PBT substance.
2	The chemical concentrations detected are lower than WHO guideline values for drinking water.
3	The MAM-PEC Model simulated calculation showed that there will be no chemical accumulation in the harbor by using this treatment technology for a long time ($PEC < PNEC$).
4	Aquatic toxicity tests of treated ballast water showed that there is no toxicity to aquatic organisms

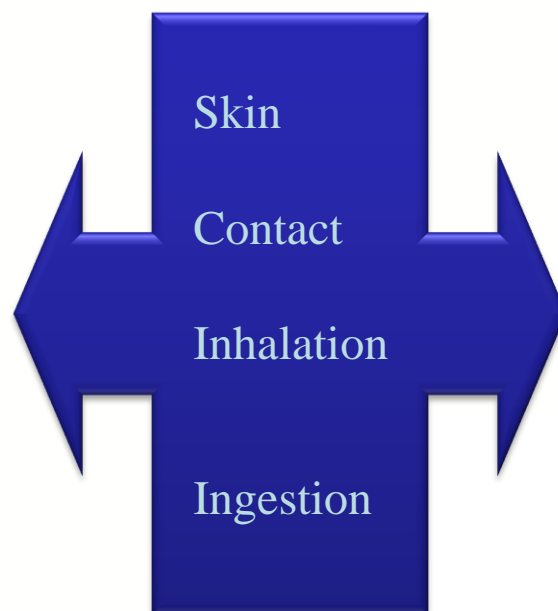
- Conclusion: BalClor™ BWMS will not cause any risk to the marine environment.**

• Human Safety

Personnel:

- Crew;
- Public;
- Visitor;
- Docker;
- Surveyor;
- PSC officer.

Exposure Scenario



Scenario:

- Maintenance;
- Handling of neutralizer;
- Sampling;
- Entering ballast tanks;
- Carrying out work on deck near to the vent heads of ballast tanks;
- Swimming;
- Seafood consuming;
- Leakage due to accident.

Assessed by the CCS, there will be no risks to all personnel



- **Vessel Safety**

- **Corrosion Test :**

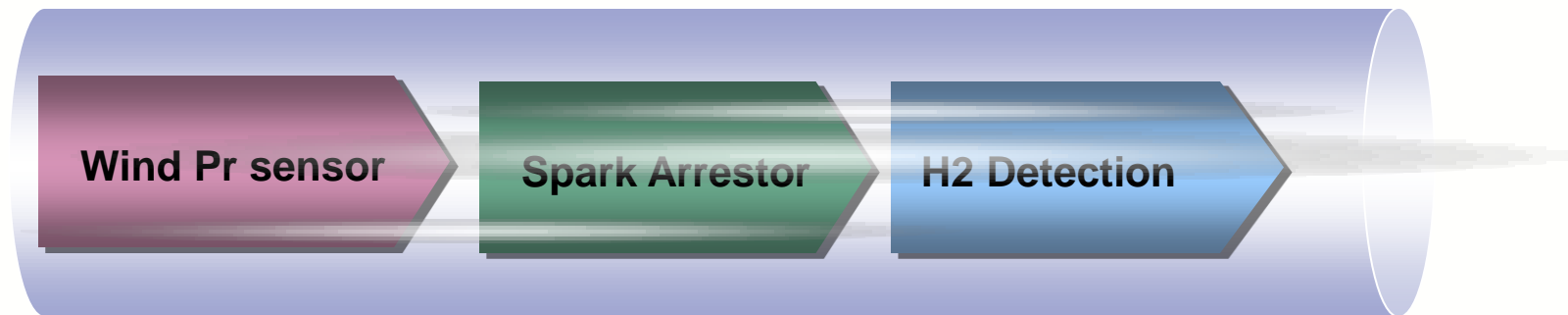
According to IMO guidelines, the organizations with qualification were commissioned to evaluate the corrosion effect of the treated ballast water (test duration is 6 months):

- Weight loss test of uncoated low carbon steel
- The corrosion evaluation of coated steel
- Corrosion test of stainless steel and Cu alloy (pitting corrosion, crevice corrosion and cyclic potentiodynamic polarization measurement)
- Corrosion test of coating properties (meet the PSPC requirement)
- Corrosion test of no-metals

All results shows that the corrosivity of treated ballast water is at the similar level to natural seawater.

– Hydrogen Safety:

- Three insurance methods:

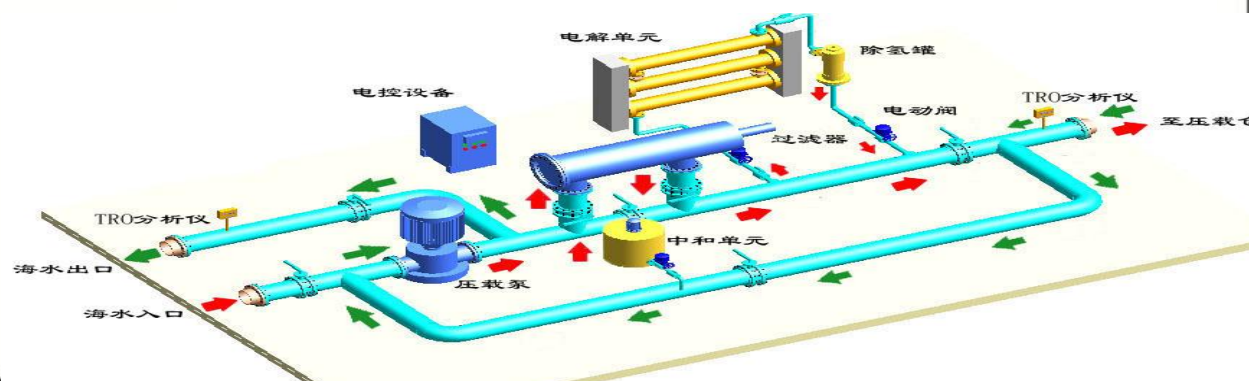


- The Detection in Type Approval showed that there was no hydrogen gas existed around the electrolytic equipment and in the headspace of ballast water tanks;
- Hydrogen gas concentration at the end of vent pipe is less than 0.28%(v/v) (explosion limit 4%~75%).

IMO evaluation report considered that the hydrogen gas safety measures of BalClor™ System is appropriate.

• System Installation Advantage

- Side-stream technology: 1-2% of total seawater volume for electrolyzing, system installation requires no modification to vessel pipe line;
- Easy application for new builds design and simply installation for retrofits;
- Low water volume required for electrolyzing, low power consumption, less installation space needed;
- High electrolysis efficiency, low power consumption.



- **Module Distributional Installation**

- Integrated design suitable for all vessel type, installation requires no modification to vessel pipe lines;
- Modular design: 4-7 modules can be installed to suitable place on vessel, especially easy application for retrofits;



NEW BUILDING



RETROFIT



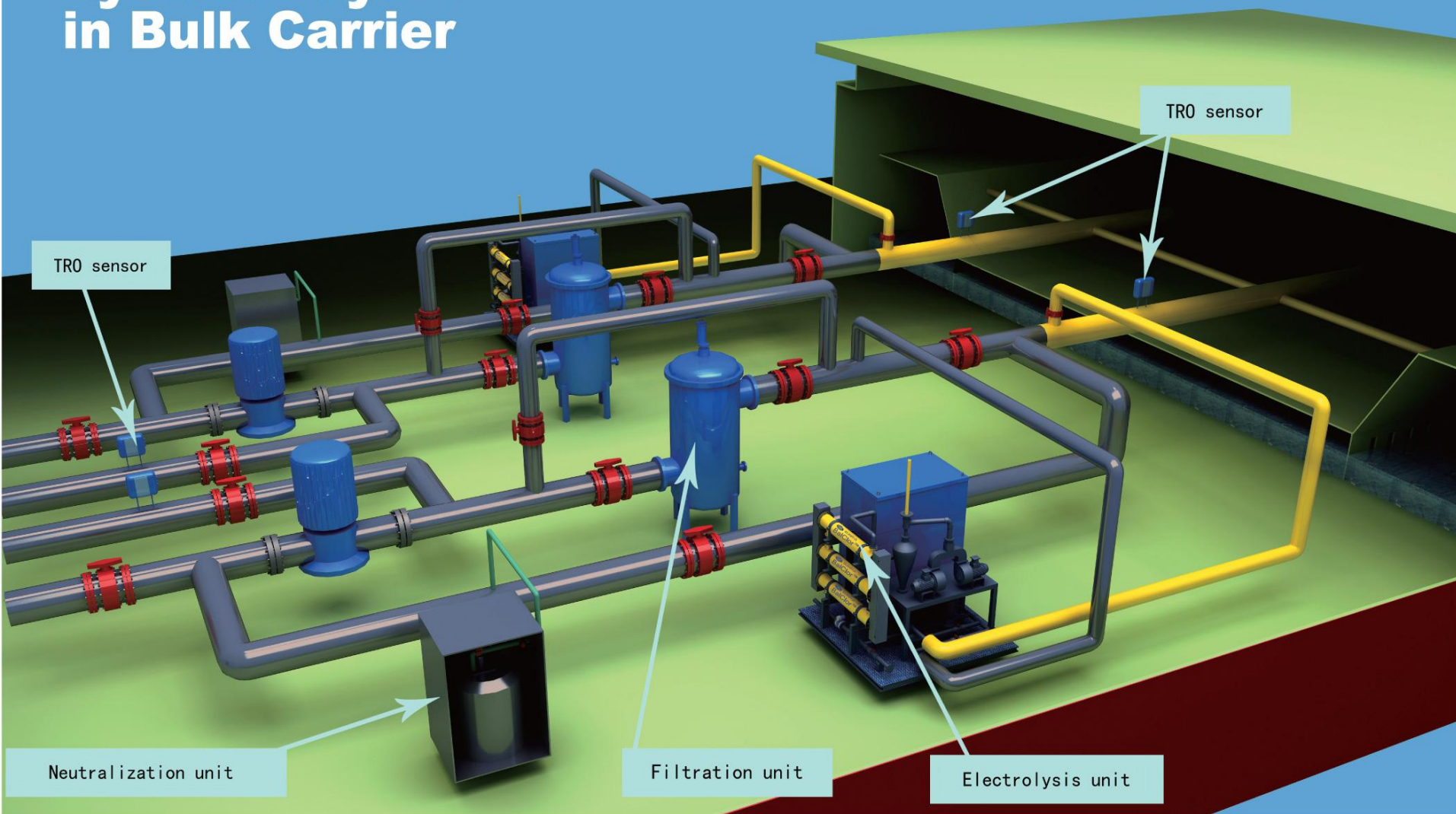
- **BalClor™ System Application**

- Applicable for fresh water (salinity < 3 PSU) voyage, two solutions:
 - Retain seawater in APT tank;
 - Install a salt tank.





System Layout in Bulk Carrier

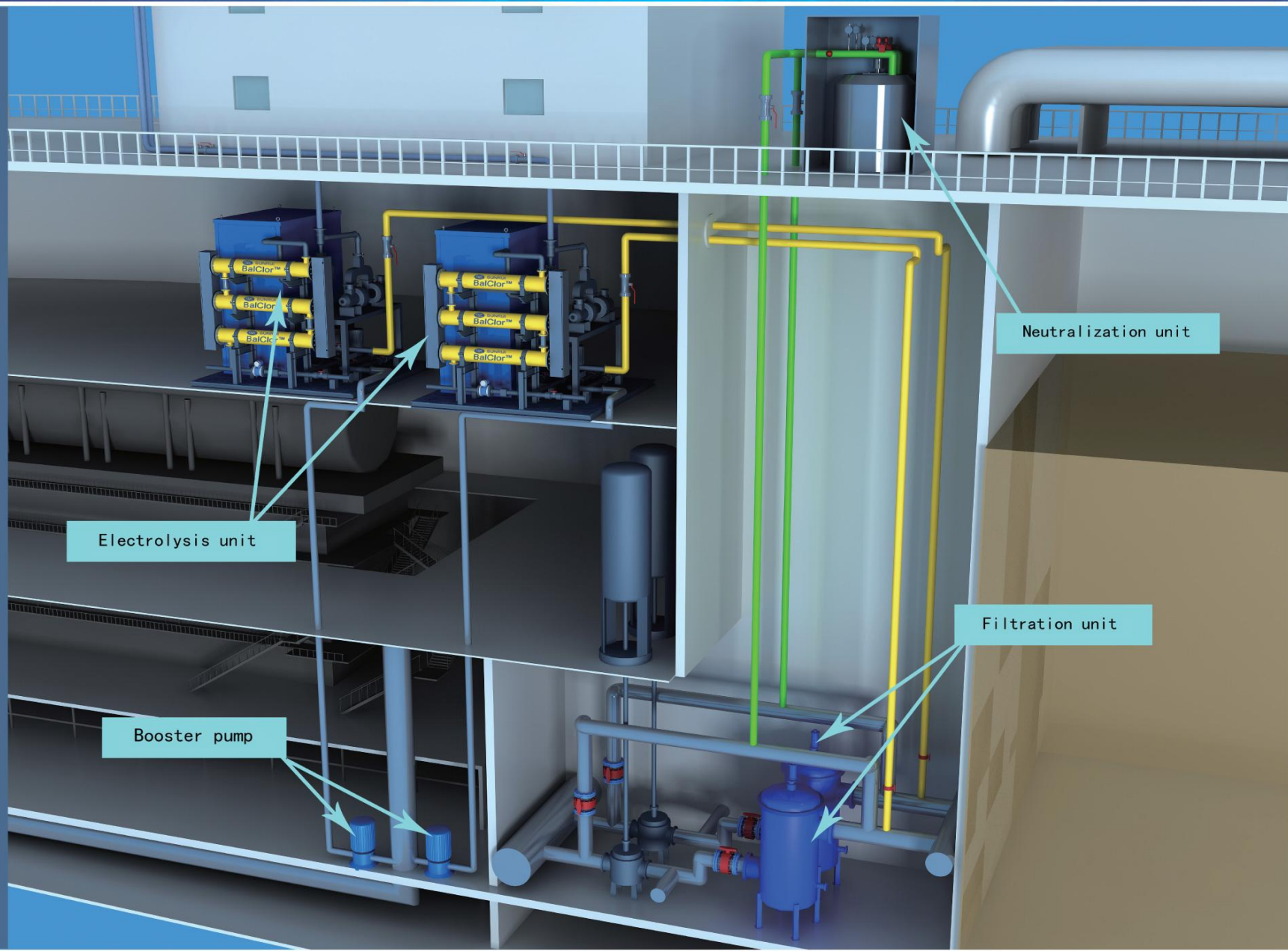




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System Layout in Oil Tanker





- Models

Model	Treatment Capacity (m3/h)	Flow Rate to Electrolyzer (m3/h)	Required Power (KW)	Dimension	
				Electrolysis Unit L(mm)×W(mm)×H(m m)	Filter L(mm)×W(mm)×H(m m)
BC-300	100-300	6	15	2500×1800×2200	788×698×1800
BC-500	301-500	6	25	2600×1800×2300	860×780×1905
BC-1000	501-1000	12	35	2900×2300×2200	1090×950×2475
BC-1500	1001-1500	20	75	3000×2600×2100	1245×1123×2615
BC -2000	1501-2000	20	100	3300×2500×2200	1350×1228×2780
BC -2500	2001-2500	36	125	3500×2900×2400	1350×1228×2780
BC -3000	2501-3000	36	150	3500×2900×2400	1525×1335×3395
BC -3500	3001-3500	36	175	3800×2400×2500	1565×1460×3585
BC -4000	3501-4000	36	200	3800×2400×2600	1565×1460×3585
BC -5000	4001-5000	45	250	4000×2800×2600	1845×1585×3860
BC-6000	5001-6000	54	300	5000×5000×2550	1525×2670×3395
BC-7000	6001-7000	65	350	5000×5000×2550	1565×2920×3585



BalClor™ System with reliable and effective technology

Electrolysis Technology

Reliable, effective with long disinfection durability; SunRui has successfully practiced electrolysis seawater to generate Sodium Hypochlorite technology for over 30 years; mature technologies has been applied to over **12 Nuclear Power Stations, 100 Thermal Stations, 10 chemical plants and 20 vessels**





- **BalClor™ System High Economic Performance**

- **Operation Cost**

- Capacity of treatment: 1000m³/h

- Power consumption: 35kw

- **Maintenance Cost**

- Core component – electrolyzer

- life span over 40 years



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Thank you for your attention!