European Maritime Safety Agency

Ballast Water Sampling Issues

SAFEMED IV Project: Training on Implementation & Compliance of the IMO's Ballast Water Management Convention for Tunisia

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Unit 1.1: Sustainability

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EMSA

Experience Building Phase

The EBP is intended to permit port States, flag States and stakeholders (e.g. owners and operators of ships, manufacturers of BWMS, and recognized organizations) to:

1. gather and submit data concerning the implementation of the Convention;

2. participate in the analysis of this data in the Ballast Water Review Group (BWRG) of the Committee; and

3. undertake a review of the text of the Convention to identify any areas where the evidence demonstrates a need for improvement of the Convention, and then develop a package of priority amendments.

Includes, and is broader than, the more specific "trial period" associated with methods for sampling and analysing ballast water during port State control (PSC)

Sampling Purpose

- Compliance with D-1 (Ballast Water Exchange (BWE))
  - 200 m depth, 200 nm from nearest land
  - 200 m depth, 50 nm from nearest land
  - Designated areas
- Compliance with D-2 (Ballast Water Performance Standard)
  - <10 ind/m³ of orgs. >50 µm
  - <10 ind/ml of orgs. <50 & > 10µm
  - Indicator microbes
    - *Escherichia coli* <250 cfu in 100 ml
    - Enterococci <100 cfu in 100 ml
    - Vibrio cholerae <1 in 100 ml or in 1 gr ww zooplankton

Different Approaches

- Approval Sampling
- Sampling on Installation
- Indicative assessment
  - A "quick and dirty" check for gross exceedence; e.g. 100 orgs = non-compliance
- In-depth (detailed) assessment
  - A detailed analysis; 10 orgs = non-compliance

Two Summaries of Organism Detection Methods


European Maritime Safety Agency - EMSA

RESEARCH STUDY

TESTING SAMPLE REPRESENTATIVENESS OF A BALLAST WATER DISCHARGE AND DEVELOPING METHODS FOR INDICATIVE ANALYSIS

REPORT No. 4

FINAL REPORT

EMSA Study 2010

Interreg IV B Ballast Water Opportunity 2012

Led to EMSA's BWM- Guidance for best practices on sampling

IMO Sampling Principles

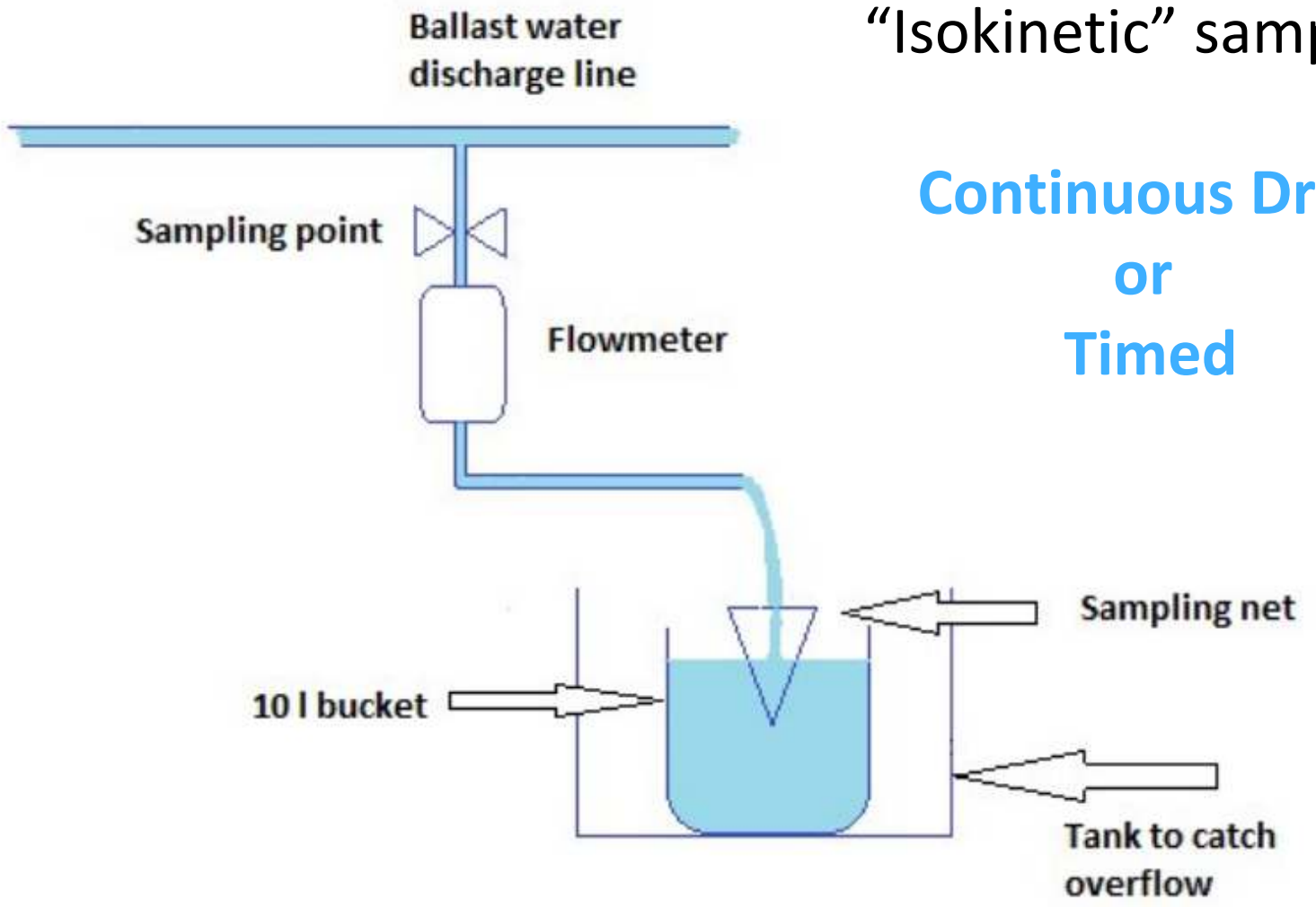
1. Protocol should be in line with IMO G2 Guidelines;
2. Result in samples that are representative of the whole discharge of ballast water from any single tank or any combination of tanks;
3. Should take account of the effects suspended sediment load;
4. Samples to be taken at appropriate discharge points;
5. The quantity and quality of samples taken should be sufficient to demonstrate compliance;
6. Safe and practical;
7. Samples should be concentrated to a manageable size, sealed and stored appropriately;
8. Samples should be fully analysed within test method holding time limit using an accredited laboratory which apply quality management system practices in accordance with EN ISO/IEC-17025 or other equivalent standards accepted at international level; and
9. Samples should be transported, handled and stored with the consideration of the chain of custody.

Where to Sample?

- The discharge line through designated sampling points;
  - where not possible ballast water tanks.
    - when tanks are emptied through direct overboard discharge valves, as in upper side wing tanks,
    - cases where the ballast system design does not enable sampling from the discharge line;
    - Inappropriate if any part of the treatment process occurs during the ballast water discharge,
    - ballast coming from pre-notified contaminated or problematic areas; or,
    - when the ballast water management system is found to be not working properly and the discharge is forbidden.

    In-tank samples may be taken via sounding or air pipes and manholes by using pumps, sampling bottles or other water containers.

Sampling



"Isokinetic" sampling

Continuous Drip
or
Timed


Samsung Triple Camera


Samsung Triple Camera


Samsung Triple Camera
Shot with my Galaxy A70


Samsung Triple Camera


Samsung Triple Camera

What and when to Sample?

- Sampling protocols considered
- Two samples should be taken
- 10 minutes maximum
- At least 5 minutes between the two samples.

- Samples not taken during the first and last 5 minutes of the discharge.
- Result should be the average of the values of these samples.
- Sampling valve should be fully open
- Flow rate less or equal to 50 litres/min should be maintained.

Possible Indicative Methods

- Accuracy
- Reliability
- Time to a result
- Expertise
- Portability
- Costs

D-1 (Ballast Water Exchange)

- Salinity
  - If salinity is below 25 psu it is unlikely that it was exchanged at sea
- Tracers of human activity
  - Presence of e.g. Nitrogen or Phosphorous may indicate nearshore BWE (river run-off in urban areas)
- Coastal species
  - Harpacticoid copepods, barnacles
- Sediment
  - High sediment load may indicate near-shore BWE, but re-suspension from tank bottom occurs

Indicative Analysis Methods

Organisms less than 50 and greater than or equal to 10 µm in minimum dimension

- Presence/absence (no viability, no counts)

  e.g. DNA, ATP (new NIOZ method), Chlorophyll a methods

  - deliver results in less than 60 minutes

- Viability and counts

  Flow cameras or flow cytometry (< 60 minutes, not portable, viability stain needed)

Indicative Analysis Methods

Organisms less than 50 and greater than or equal to 10 µm in minimum dimension

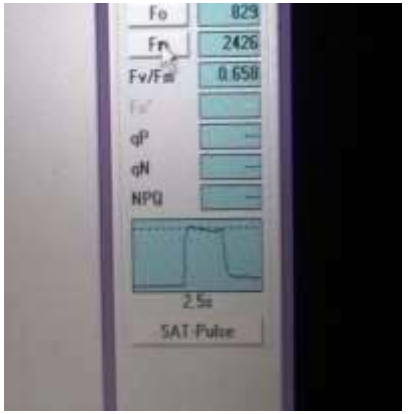
Problem with machine count is cell vs single colony and human error

Best compromise: PAM

portable, easy to use, low expertise needed

Viability in less than 10 minutes

No counts, but biomass and Chl a indication



New Phytoplankton Methods

Ballast Water OK

(Safe to de-ballast)

Ballast Water Bad

(Please see local authorities)

- Thumbs up/Thumbs down

Welschmeyer

Turner

Hach

Bbe

This is now considered a commercially viable market

Indicative Analysis Methods

Organisms greater than or equal to 50 µm in minimum dimension

Presence/absence methods (no viability, no counts)

e.g. DNA, ATP methods deliver results in less than 60 minutes

Counts (no viabilty)

Hand-held flow cameras (less than 30 minutes)

Best compromise: Stereomicroscope (counts & viability)

portable, easy to use, high expertise needed

results in less than 20 minutes

D-2 Bacteria

Presence/absence methods (no cfu and/or counts)

e.g. DNA, ATP methods deliver results in less than 60 minutes

All methods to determine cfu require incubation time of 24 - 72 hours

Best compromise: Hand-held fluorometer

portable, easy to use, low expertise needed

presence/absence in < 10 mins to 4 hours

semiquantitative, i.e. high reading = high bacteria numbers

Detailed Analysis

- Work according to good laboratory practice standards
- Most accurate analysis technologies should be used
- At best consider living samples
- Keep time between sample taking and sample analysis as short as possible
- Standard being developed by ISO and IMO

Detailed Analysis Methods

D-2 organism

Organisms less than 50 microns and greater than 10 microns in dimension

Microscopy, bright-field epifluorescens

Detailed Analysis Methods

D-2 organisms greater than or equal to 50 micrometres in minimum dimension

Detailed Analysis Methods

Organisms less than 50 and greater than or equal to 10 µm in minimum dimension

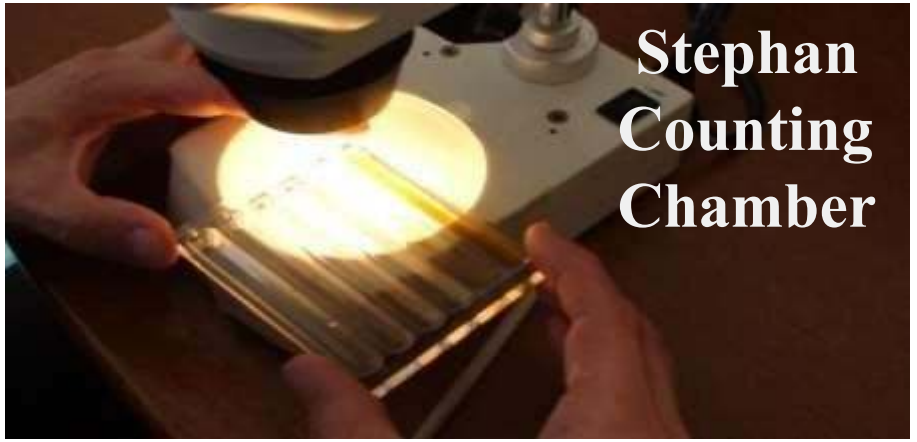
- Viability and counts

  Flow cameras or flow cytometry (< 60 minutes, not portable, viability stain needed)

Detailed Analysis Methods

D-2 organisms greater than or equal to 50 micrometres in minimum dimension

- **Microscopic analysis**
- **Stains don´t work 100%**
- **Living dead judgement by a scientist**



Detailed Analysis Methods

D-2 methods for bacteria analysis


EMSA
Any questions?
Thank you!
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