The Methodology to Evaluate BWMS for Risks to the Environment, Humans and Ship

Jan Linders, GESAMP-BWWG chair
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The Joint Group of Experts on the Scientific Aspects of Marine environmental Protection

an inter-agency advisory body of the United Nations system
UN-Organizations

Member Institutions of GESAMP

- IMO
- FAO
- UNESCO-IOC
- WMO
- IAEA

- UN-DOALOS
- UNEP
- UNIDO
- UNDP
GESAMP-BWWG

= WG34 (Standing, since 2006):
Scientific evaluation of the active substances and relevant chemicals in BWMS proposals on the potential for unreasonable risk to the environment, human health, property (i.e. ship) or resources in support of the Ballast Water Convention

(IMO; Jan Linders, The Netherlands, chair)
Members from different countries: Portugal, Sweden, UK, Japan, Republic of Korea, USA, Canada, Nigeria, selected on the basis of relevant expertise from the GESAMP pool of experts and supported by 1 or 2 consultants
Approval Process

- Procedure G9
- Active Substance
  - Yes
    - Basic Approval
    - Final approval
    - GESAMP/MEPC
  - No
    - Guideline G8
      - Whole effluent test
      - Land based type approval
      - Shipboard type approval
      - Applicant/Administration

Final Product
Risk Assessment

- Exposure estimation
- Data evaluation
- Hazard identification
- Dose-response assessment

- Data set
  - Emission rates
    - Environmental distribution
      - Exposure levels, concentrations, intakes

- Toxicity data single species
  - Extrapolation
    - No-effect levels

- Risk characterisation
  - (P)EC/PNEC, MOS, TER
Evaluation of BWMS

• Environment: Determination of PEC, PNEC and ratio PEC/PNEC
  – Relevant substances and treated BW
  – Water and sediment,
  – Fish, Daphnia and algae
  – Marine organisms
  – PBT (incl. CMR)

• Humans, treated BW
  – Workers
    • Crew and port state control
    • Unit operations, ventilation, storage, temperature
  – General public
    • Swimming (oral, dermal and inhalatory route)
    • Consumption of seafood

• Ship
  – Corrosion
Information on Effects

- Literature data
  - From scientific papers
  - From evaluation by recognized bodies (EPA, EU, OECD, WHO, etc.)
- Acute and chronic tests
  - According to internationally accepted guidelines (OECD, EPA, etc.)
  - For fresh water and marine water environments
- Evaluation leading to a PNEC
  - For the active substance(s)
  - For relevant chemicals, like DBPs
  - According to accepted Methodology
- Laboratory toxicity tests with treated BW at Basic Approval
- Whole Effluent Toxicity (WET) tests at Final Approval
WET tests

• 1 For the **Basic** Approval process, the discharge testing should be performed in a **laboratory** using techniques and equipment to simulate Ballast Water Discharge following treatment by the Active Substance or Preparation.

• 2 For **Final** Approval, the discharge testing should be performed as part of the **land-based** type approval process using the treated ballast water discharge.
Stock Taking Workshop #5

- Structure ERA
- TRO measurements
- Temperature effects
- Corrosion
- Higher tier testing
### Structure ERA, BA

<table>
<thead>
<tr>
<th>Risk assessment tier 1</th>
<th>PEC/PNEC, incl. near sea PEC/PNEC</th>
<th>Using modeling and literature data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk assessment tier 2</td>
<td>Effects in lab tests</td>
<td>-</td>
</tr>
<tr>
<td>Risk assessment tier 3</td>
<td>Tiers 1 and 2 in agreement?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Proposal</td>
<td>Preference Risk Assessment 1</td>
<td></td>
</tr>
</tbody>
</table>
## Structure ERA, FA

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Risk assessment tier 2</td>
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</tr>
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<td>Tiers 1 and 2 in agreement?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Proposal</td>
<td>Preference Risk Assessment 2</td>
<td></td>
</tr>
</tbody>
</table>
Approach

• Apply the quality validity criteria for ecotoxicity tests strictly, if appropriate, relying on expert judgment
• Literature data are preferred over laboratory-scale ecotoxicity testing at BA
• WET test results at FA are preferred over literature data
• Near sea scenario as defined
TRO measurements

• Under current circumstances, the Group recommends TRO monitoring by the DPD colorimetric method as a preferred measuring method for the TRO
• The Group anticipated that monitoring technologies of TRO by the amperometric method are likely to be developed further by the industry
• Position may be changed in future
Temperature effects

• Temperature effects on degradation of AS and formation of DBPs will be described using the Arrhenius equation according to the Q10 approach with a Q10 value of 2.58 assuming the degradation of the AS found in literature is 20 °C except if stated otherwise.

• Not more than to 10 °C

• $DT50_T = DT50_{20} \cdot e^{-0.095(T-20)}$

• Value of 0.095 is based on Q10-value of 2.58 (EFSA, 2007).
Corrosion

• Left over from last MEPC
• Agreement reached between GESAMP-BWWG and NACE International and IPPIC
• Results:
  – For systems using TRO as Active Substance no corrosion testing is needed if $\text{TRO} < 10 \text{ mg/L as } \text{Cl}_2$
  – Use of artificial seawater is preferred but natural seawater is acceptable
  – Final text for Methodology of BWWG is agreed
Higher tier testing

• Several tests under discussion at BWWG:
  – Tests on CMR properties
  – Two algal species at BA and at FA
  – Inclusion of non-diatom algal test
  – Preferred algal species is *Skeletonema costatum*
  – Organism to remove is *Phaeodactylum tricornutum*
  – Introduction of TIE and/or micronucleus test

• However, not feasible until BWM Convention has entered into force
### Phase II CHERABS

<table>
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<tr>
<th>Chemical</th>
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<tbody>
<tr>
<td>1,2-dichloroethane</td>
</tr>
<tr>
<td>dibromomethane</td>
</tr>
<tr>
<td>acetaldehyde</td>
</tr>
<tr>
<td>formaldehyde</td>
</tr>
<tr>
<td>bromochloroacetonitrile</td>
</tr>
<tr>
<td>tetrachloromethane</td>
</tr>
<tr>
<td>chloral hydrate</td>
</tr>
<tr>
<td>dalapon</td>
</tr>
<tr>
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<td>trichloroacetonitrile</td>
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<tr>
<td>1,2-dichloropropane</td>
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<tr>
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<tr>
<td>bromate ion</td>
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<tr>
<td>dichlorobromoacetic acid</td>
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<tr>
<td>1,1,2-trichloroethane</td>
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<tr>
<td>trichloroethene</td>
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<td>monochloroacetonitrile</td>
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<tr>
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Conclusions

• STWs show useful, yearly maybe too often
• Clear structure in Environmental Risk Assessment strategy
• Preferred method for TRO measurements
• Agreement on corrosion with NACE and IPPIC
• Phase II of GESAMP-BWWG database operational in 2014
• Database available at MEPC66
Recommendations

- Applicants to make use of the database at submissions for BA and FA
- Application of near sea scenario
- Additional testing proposed if BWM Convention enters into force
Thank you for your kind attention