

Whole Effluent Assessment: flexible approach to control the effluents

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The logo for COHIBA, featuring the word in a bold, sans-serif font. The 'O' is a circle containing a white silhouette of a fish. The letters are colored in a gradient from light blue to dark teal.

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Baltic Sea Region
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Introduction

- Chemical methods give quantitative information of the compounds, no view on the transformation products, effects of the individual compounds, or combined effects of all the chemicals present in the effluent
 - Substance by substance approach
- Biological methods give information on the potential risks of the effluent to cause adverse effects on aquatic organisms, no view on the causative compounds unless further analyses are carried out
 - Effect-based approach

Limitations of chemical assessment

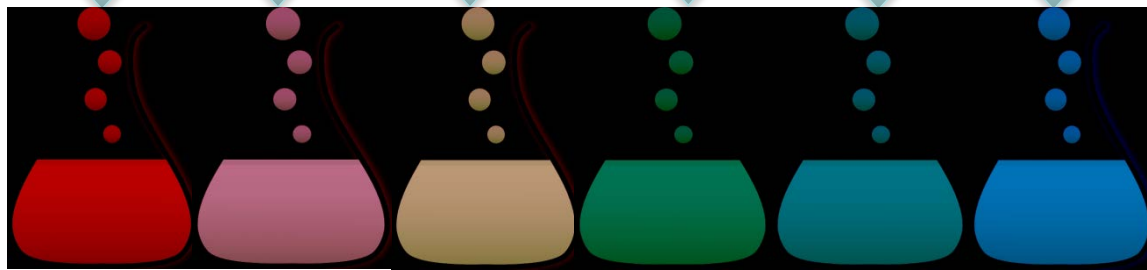
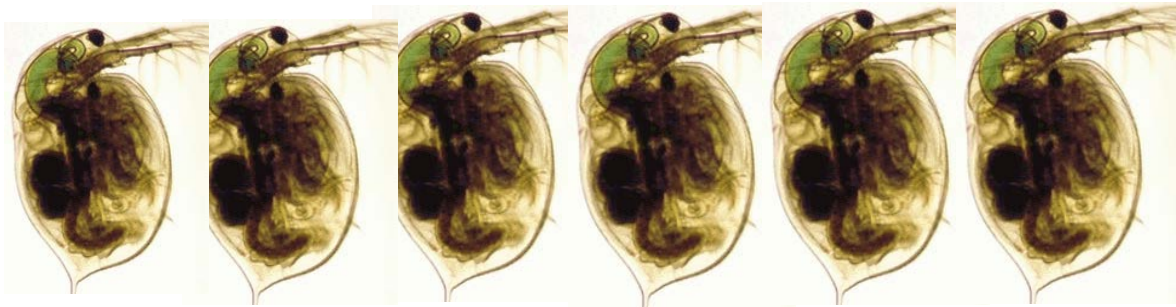
- Many substances can not be identified or detected through analysis
- The number of substances too large
- Missing or incomplete data on the environmental characteristics for many substances
- Micropollutants and degradation products out of picture
- Combined effects are not being considered

Advantages of WEA

- **Preventative method**
- No knowledge of the effluent composition and concentration needed
- Evaluate the effects of effluents/influents as a whole
- Comprehensive picture of the effluent's environmental effects
- Link between chemistry and ecology
 - Indicates the effects of an effluent on survival, growth and/or reproduction of organisms
 - “Worst case scenario”
- Cost-effective method

Basic principles of WEA

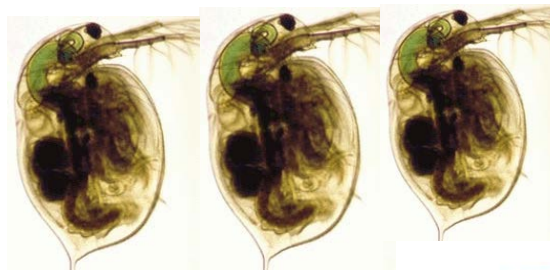
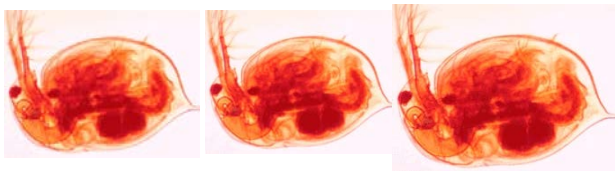
- Detect harmful effects of waste waters proactively
 - by exposing aquatic test organisms
 - directly to whole effluent samples
 - in controlled laboratory conditions



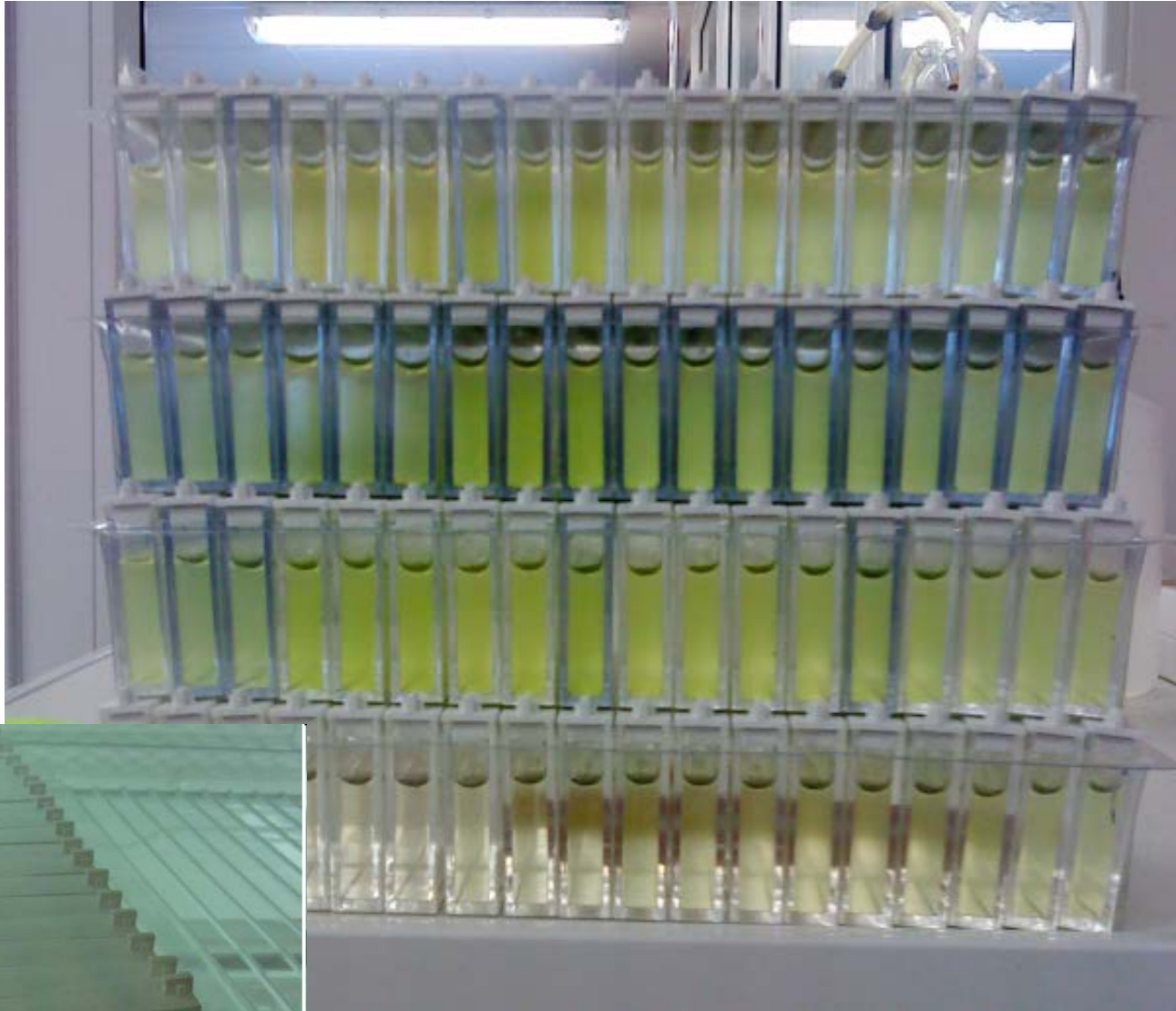
100% 50% 25% 12,5% 6,25% 0%



48h



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Comparison of toxicity tests and chemical analyses

- Based on the COHIBA WP3 work performed by one partner in 2009 – 2011
- Comparison of laboratory **working time**, includes technical and academic personnel
- Short term tests vs. 5 groups of chemical analyses

Working time

| Toxicity tests | Chemical analyses |
|-------------------|--------------------|
| 28 samples | 34 samples |
| 36 days | 156 days |
| 3 tests | 5 substance groups |
| time/sample 1,3 d | time/sample 4,6 d |

NOTES:

- 1) Only acute tests were included
- 2) All the 11 HELCOM priority substances were not included

Proposed limit values for acute toxicity tests

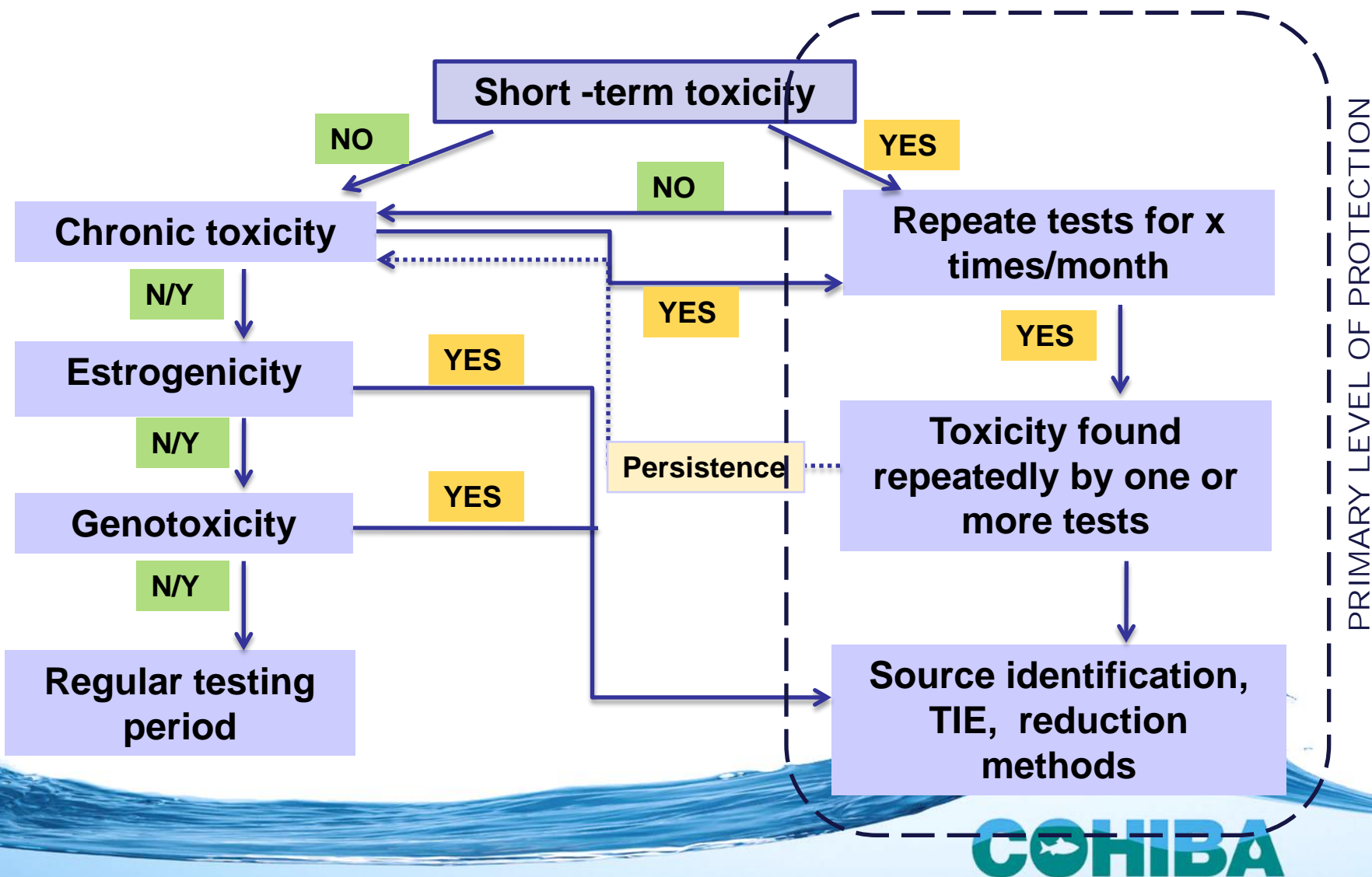
- 48 h *Daphnia magna*, *Artemia salina* and Kit tests
 - at the highest possible test concentration of 95 %,
 - inhibition must not exceed 20 %
- Algae growth inhibition and light bacterium tests
 - at the highest possible test concentration of
 - 80 %, inhibition must not exceed 30 %

Proposed limit values for chronic toxicity tests (1)

- Egg-larvae test
 - Mortality of fertilizes eggs and hatched larvae, in undiluted effluent, must not exceed 40 %
- Daphnia magna reproduction test
 - Compared to the controls no statistically significant effects should be observable at the effluent dilution of 25 %

Proposed limit values for chronic toxicity tests (2)

- Vitellogenin test
 - Compared to the controls no statistically significant induction should be observable at the effluent dilution of 5 %
- Umu-test
 - If at the highest test concentration of effluent dilution of 1:1.5, the induction ratio is ≥ 1.5 the effluent is considered as genotoxic



In conclusion

- WEA is a preventing tool for water protection
- Effluents contain tens of thousands of substances, by-products and transformation products
- It is not possible to analyze all these compounds
- It is not possible to determine EQS for all these compounds and their metabolites
- The use of chemicals increases
 - no use to discharge them into the Baltic Sea
- High quality analytical methods valuable
 - in controlling individual substances
 - in identifying restricted substances or substances with limited use

Thank You!



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