

How can we improve the sediment risk assessment in the Port of Hamburg Maintenance Dredging Program? – A new concept is needed

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Introduction: Due to high sediment deposition in the Elbe estuary, approximately 6 Mio. m³ sediment per year had to be dredged in the Port of Hamburg in the last years; another 15 Mio. m³ in the fairway maintained by the Federal Waterways Administration [1]. International and national regulations require for the disposal decision a proper sediment risk assessment based on physical, ecotoxicological and chemical analyses [2, 3, 4, 5]. According to national dredged material management guidelines a test-set of freshwater and, in case of disposal to the sea, marine bioassays is required.

Methods: The ecotoxicological test results of sediment samples of the Port of Hamburg and the Elbe estuary in the period of 2005-2008 and partly 2009 were analysed with respect of their test specific intra- and interlaboratory precision. Moreover, temporal and spatial variability analyses of the test results were conducted.

Results: Although national or international standardised bioassays are applied for the sediment risk assessment of porewater, elutriates and whole sediments, the precision of the tests is in some cases rather low. According to national regulations the test results are not expressed as EC₅₀-values, but LID-values (Lowest Ineffective Dilution) are used. The ecotoxicological sediment classification is based on the result of the most sensitive test, irrespective of the results of the other tests. The purpose of this approach is to apply the precautionary principle. For sediments of the Elbe estuary the algae test is in most cases the most sensitive test, thus dominating the ecotoxicological sediment classification. However, the results of especially this algae test are currently the most imprecise.

Discussion: Therefore, the current ecotoxicological risk assessment praxis is linked with high uncertainty: it is based on the sole answer of the most sensitive test, which often is known as being rather unprecise, and does not take the other results from the remaining tests of the complete test-set into account. Although also other lines of evidence have to be taken into account to derive the final dredged material management decision, it does not help when

the most important ecotoxicological test delivers unreliable answers to questions like: is the risk of a disposal of the dredged material to the water acceptable? Are the high costs for land deposition based on these results justified? Moreover, it is not possible to pre-estimate the test-results due to their variability, but the logistic organisation of the disposal, especially ordering a large hopper dredger for a disposal to the sea, needs a decision half a year in advance.

To improve the sediment risk assessment in the Port of Hamburg Maintenance Dredging Program three steps are essential:

The first and most important step is to further harmonise the ecotoxicological test procedures, until it delivers results with high precision and accuracy. Ecotoxicological sediment testing is more complex in comparison to the well standardised single substance testing and so it still is an ongoing national and international task to develop robust test procedures. Thus, new state-of-the art guidance documents and comprehensive test measurement requirements for the preparation of sediments samples and test procedures have been developed for the application to the sediment samples of the Port of Hamburg and the Elbe estuary. Second, for the calculation of the test results the complete dilution series should be considered (e.g. by EC₅₀-values).

The third, and also important step is the application and further development of methods which integrate the complete test-set results in the ecotoxicological risk assessment in national dredged material management guidelines [6].

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