

# The usefulness of bioassays for sediment quality assessment A question of reproducibility, uncertainty and interpretation

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**Introduction:** In 2003, den Besten et al. (2003) [1] published an overview over the use of ecotoxicity data in European sediment risk assessment approaches. A joined workshop of SedNet and the Sullied Sediments project in 2018 made clear that 15 years later, the use of ecotoxicological data in sediment and dredged material quality assessment is still seen very differently among stakeholders in Europe: Italy, for example, implemented a triad approach using bioassays as one line of evidence in 2017. The Netherlands on the other hand, after a period of using bioassays for dredged material assessment, decided to skip them and now solely rely on chemical data. In Germany, dredged material from Federal Waterways has to be analyzed for ecotoxicological effects, but stakeholders (e.g. ports) are still doubtful regarding their usefulness, reliability, and whether it is worth the effort.

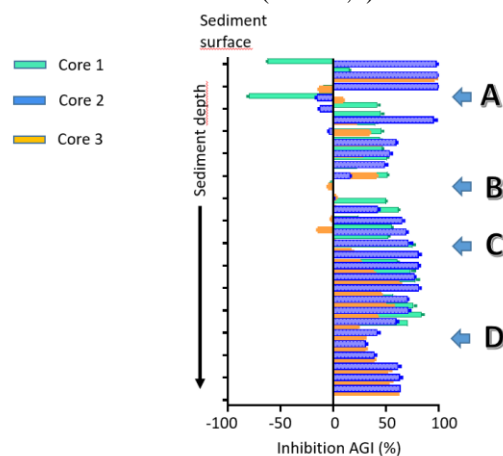
In reference to these concerns, two studies were undertaken to investigate the reproducibility of results from a biotest battery comprising two regulatory assays and – in one study – additionally a bacterial contact test.

**Methods:** Principal of investigation: Sediment cores of up to 80 cm length were taken 3 times every 2 weeks from the same location. The core was divided horizontally into slices of 1.5 to 3 cm thickness.

Analysis: Vertical element profiles were determined by portable XRAF to identify comparable layers in the various cores from the same location. Biotesting: Algae growth inhibition assay with *Raphidocelis subcapitata*, the luminescence bacteria test with *Allivibrio fischeri* (both on elutriates) and the bacterial sediment contact assay with *Arthrobacter globiformis*, were carried out applying a miniaturized protocol. Locations: a) in the Alte Süderelbe, a sidearm of the Elbe river which is not tidally influenced, in February/March 2017. Samples were taken by hand after wading in the shallow water away from the river bank for about 8 meters; b) in a small harbor upstream of Hamburg (Hohendeicher Hafen), September, October 2018. Samples were taken from a wooden swimming pier without boat traffic.

**Results:** Currently, only the study of the Alte Süderelbe is completed. Only preliminary results from the Hohendeicher Hafen are available at the time of abstract submission. This study will be finalized by November 2018.

Results Alte Süderelbe: Element profiles for copper, chromium and iron were used to identify the corresponding layers of the different cores. In a second step the different results for the algae growth inhibition test (AGI) and the luminescence bacteria test (LBT) were compared. Ecotox data showed good agreement between the different cores especially in the following zones (only AGI data shown in Fig. 1): A and B: no toxicity or stimulation in all 3 cores. C: Increase in toxicity to > 60 % below 29 cm (1, 2). D: minimum of about 30 % (cores 2,3).



**Fig. 1:** AGI data for different sediment cores.

The first study points towards good reproducibility of AGI and LBT data even between cores from the same location, taken at different times. There were, however, also differences that may be due to the type of sampling, which especially disturbed the upper sediment layer. For the second study, samples are taken from the pier, reducing the amount of resuspended sediment. Data will be shown and discussed at the conference.

**Reference:** [1] den Besten PJ et al. (2003). *J Soils Sediments* 3:144-162 doi:10.1065/jss2003.08.084.