

# Assessing the status quo of the sediment quality in the Lahn River

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**Introduction:** In frame of the EU-Life IP “LiLa-Living Lahn” (LIFE14-IPE/DE/022) the status quo of the sediments quality in the Lahn River/Germany is assessed over a three years period by means of a combined approach with chemical- and effect assessment. Up to now only few information on the sediment quality in the Lahn is available. However, Lahn-sediments are assumed to be a potential source for pollution and thereof one reason for the Lahn not to meet the objectives of the WFD. This study is regarded as basis for the development of a sediment management concept for the Lahn. Results of the first two years (2016-2017) of the monitoring are discussed in the following, also with regard to the applicability of the chosen approach for the prioritization slightly and severely as well as between slightly and moderate contaminated sites.

**Methods:** In field survey in 2016 and 2017, 55 sites along the Lahn were characterized for their sediment quality. Sediments were investigated with regard to sediment contamination and effects on biota. The toxic potential was assessed by means of sediment quality guidelines (de Deckere et al. 2011) and WHO-TEQ values for PCDD/F and dl PCB. Direct toxicity was assessed by means of aquatic bioassays (luminescent bacteria DIN EN ISO 11348-1-3, algae DIN 38412 - L33, daphnids DIN 38412 - L30; Lemna ISO 20079, zebrafish DIN 38412 - L30) and by means of sediment-contact bioassays (nematodes ISO 10872, watermilfoil ISO 16191).

**Results:** Mean PEC-Q values (with 33 substances of which a SQG and data from chemical analyses were available) varied from 0.2 to 1.8 along the Lahn river. Pollutants that committed mostly to the toxic potential along the entire river were nickel, chromium, and higher chlorinated biphenyls, as well as lead and zinc on the last 20 km above the Lahn's mouth in the Rhine. Sediments varied strongly in their toxic potential between the sites and between the years. WHO-TEQ values were low in the average but showed a gradient from the upper, less-urbanized part of the Lahn (mean 4.8 ng WHO-TEQ/kg) to the lower, urbanized part (mean 12.8 ng WHO-TEQ/kg). However, elevated WHO-TEQ values in the lower Lahn occurred due to relatively higher contents of PCDDs in the sediments. The total concentrations of

single compounds were higher in 2017 compared to 2016. Sediments varied strongly in their strength of effect from not to highly toxic along the Lahn and also between the years. Strongest effects were detected in 2016, but on average, toxic effects were stronger in 2017.

## Discussion:

The toxic potential and strength of effects in bioassays varied between the years which can be explained by winter floods of varying intensities. No gradient of the toxic potential along the river from the source to the mouth was observed and is attributed to the inhibited sediment connectivity of the impounded Lahn. Especially metals contributed to the toxic potential which probably originate from historical mining sites. Single sites seemed to be influenced by varying sources. The increase of WHO-TEQ values to the mouth was attributed to geogenic background concentrations, while PCDF, indicating anthropogenic sources, stayed equal from the source to the mouth. A high variation of sites with relevant toxic potential and effects between the years was observed and thus complicates the prioritization between contaminated sites as a base for the establishing of a sediment management concept and related management options. Overall no sites with severe contamination were discovered. However, although a wide set of lines of evidence was applied, wider as e.g. prescribed for dredging activities in Germany (HABAB-WSV 2017); a prioritization of the slightly to moderate contaminated sites by means of the applied approach proved difficult. Therefore, the continuing monitoring was extended by *in vitro* bioassays for specific effects and the assessment of *in situ* alterations of meiobenthic communities during the years 2017 and 2018. Moreover, the monitoring will continue with a smaller set of sites, in order to monitor ecological measures with sediment relevance along the river till the end of the project in 2025.

**References:** [1] De Deckere et al (2011) *J Soils Sediments* 11:504-517; [2] HABAB-WSV (2017), BfG/GDWS.