

# Side Structures along the Elbe - the local and regional risk from sediments -

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**Introduction:** Along the German part of the Elbe River, more than 1000 “side structures” form potential sinks of contaminated sediment. These structures are mostly remains of previous river courses which have been shut off by natural courses or anthropogenic alterations of the river (oxbow lakes) or are floodplain lakes that were formed during high water conditions. These water bodies sometimes have a small opening towards the Elbe, or are hydrodynamically connected only in situations of high discharges. High discharges in the Elbe River, however, are mainly responsible for transporting historic contaminants along with suspended matter from former historic sources in the middle Elbe downstream. As these may settle when the current dies down at the end of a high discharge period, side structures have been under suspicion to have accumulated contaminated material over the last decades.

Almost nothing was known about the erodibility and contamination of sediment in these lakes. A preliminary investigation however showed that the total surface of side structures in the Elbe floodplain adds up to about 50 km<sup>2</sup>. In case that deposited sediment is contaminated and only a layer of 20 cm is prone to be resuspended and transported during flooding, 10 mio m<sup>3</sup> of contaminated sediment could potentially be added to the contaminant load during a high water event.

A study was carried out to evaluate the risk from these side structures for the environmental quality of the Elbe river.

## **Methods:**

In this study, 15 side structures were investigated and 1 to 3 locations sampled. Sediment cores were taken in order to achieve the following information:

- Depth of sediment layer
- Erodibility of surface sediment, measured immediately after sampling – using the Gust Microcosm,
- Eroded mass at over-critical shear stress, measured in the lab by eroding a sediment core for one hour and collecting the suspended sediment matter.
- Chemical contamination
- Ecotoxicological effects

## **Results and Discussion**

All side structures that were sampled exceeded the national quality guidelines for sediments which have been set by the International Commission for the Protection of the Elbe. In some cases very high concentrations were reached such as 1300 µg/kg dw for p,p-DDD, up to 61 mg/kg for Hg and 39 mg/kg for Cd. Erodibility varied a lot with critical shear stresses of less than 1 cm/s to more than 2 cm/s. Ecotoxicological data were also very different between side structures and sampling locations, but partly indicating very high inhibitions in the sediment contact test with *Arthrobacter globiformes* and in the algae growth inhibition test with *Pseudokirchneriella subcapitata*.

An integrated evaluation of all information led to a classification of 7 sites out of 15 to be of high risk, 7 to be of medium risk and only one site to be of low risk for the environmental quality of the Elbe River.

## **Conclusion:**

This study has been a first survey examining only 15 out of more than 1000 side structures. Nevertheless it became clear, that side structures are very relevant with regard to the chemical contamination of the Elbe River. But another important aspect is the risk that these sediments pose when there is no high water situation. Most of the side structures that we visited are used for fishing by local people who are not aware of bioaccumulating substances in the sediments and – as they also look for carp and eels – probably in their catch, too. Information on this issue has to be relayed to the local community.