# From monitoring to measures: Historical contaminated sediments in the Elbe river basin

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**Introduction:** Sediment management under the EU Water Framework Directive will need a wider scope with *in situ* technologies embedded in a modern system of risk assessment and communication on the river basin scale. A new initiative for Europe-wide activities in the field of sediment management technology could start in the course of the forthcoming strategies against chemical pollution of surface waters (WFD article 16), i.e. establishment of a program of measures until 2009 for sources of priority substances including the specific source/pathway "historical pollution from sediment"[1]. In the view of the size of the problems in Europe[2], the guidance to innovative remedial measures and the experience from successful problem solutions in the United States cannot be ignored[3]. Our presentation refers to chapter. 6 "Risk reduction of contaminated sediments in the Elbe river basin" in a study on behalf of the Hamburg Port Authority and River Basin Community of the Elbe[4].

**Methods:** The different objectives of risk assessment and monitoring on solid material involve specific techniques favoring different media (suspended particulate matter, sediments, biota)[5]: (i) Surveillance, i.e., source screening and preliminary site characterization; (ii) survey, i.e., identification of anomalies and basic characterization on the regional to river basin scale; (iii) mass balances, including "weight of evidence"-approaches (see abstract by Heise et al.[6]). A fourth sediment monitoring issue under the WFD will be assessing risks and functioning of measures, in particular, monitoring before and after remediation of contaminated sediments. In this field, initial recommendations have been presented in a guidance document of the U.S. Environmental Protection Agency[7] and for remediation dredging by the U.S. National Research Council[8]: How to assess and monitor the five "R's" – the *risks* arising from *residuals, resuspension, release and recontamination?* U.S. focus is on remediation dredging, in-situ capping and monitored natural recovery (MNR); these technologies all rely on contaminant source control; monitoring programs should include multiple lines of evidence that include chemical, physical, geotechnical, and biological metrics, and modelling in order to evaluate, with adequate certainty, the effectiveness of the chosen approach at a site[9, 3].

**Results:** The examples from the upper Elbe River catchment give special emphasis on the utilization of geochemically-based technology for sediment remediation, which can be applied in different parts of a river basin[10]. For a yachting harbor, a draft approval has been made which involves a patented excavation procedure; monitoring of the subaqueous depot with an active barrier system was performed using dialysis sampler and diffusional gradient technique probes[11]. The MNR potential is assessed according to typical lines of evidence, e.g., contamination burial, mechanical and chemical mobility, transformation to less toxic forms and dilution due to dispersion[7]. Although strict criteria are not fulfilled in many floodplains of the Elbe river catchment area, it can be stated that the alluvial soils offer a high natural retential potential for a wide spectrum of contaminants[12]. In the historical contamination of the Mulde river, the high concentration of PCCD/F's and their low degradation potential is the limiting factor for applying MNR[13].

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