

Sediment and biota monitoring of an offshore dredged-material disposal site in the German Bight - Assessment by means of the OSPAR-criteria

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Introduction: In the years 2005 and 2010, about 6.5 Mio. m³ of material dredged from the Hamburg waterway in the River Elbe were disposed of at a site in the German Bight south of the island of Helgoland [1]. In order to assess potential ecological impacts on the marine environment, a comprehensive programme was established and is monitoring the disposal operations. The monitoring programme includes, among other parameters, the quantification of contaminants in sediments and biota as required by a Joint Agreement between the Hamburg Port Authority and the Federal State of Schleswig-Holstein. As defined in this agreement, the findings on contaminant accumulation in both matrices have to be evaluated on a regional and a temporal scale against the assessment criteria recommended by OSPAR [2].

Methods: The monitoring area covers the disposal site itself, a 12-km circle surrounding it, and reference sites. The investigations included chemical analyses of sediments (i.a. trace metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organo-tin compounds, DDT and its metabolites, chlorobenzenes). Samples have been taken by Van Veen Grab Sampler in the different parts of the monitoring area during 14 sampling campaigns so far since July 2005. In order to cover different trophic levels, three different groups of organisms were sampled. The investigations in the biota consisted of measurement of PCBs, PAH, trace metals, and organo-tin compounds in soft tissue of mussels (*Abra alba*) and snails (*Buccinum undatum*), and in different tissues (muscle, liver) of benthic fish (*Limanda limanda*).

Results: Significant increases of inorganic and organic contaminants were observed locally in the sediments compared with the background conditions before the disposal operations began. Only with PCB 101 and phenanthrene in sediments can the observed exceedances of the OSPAR assessment criteria [2] be attributed to the disposal of dredged material, and this influence remained limited to the disposal site itself. PCB118 and benzo(ghi)perylene concentrations in sediments do not meet the criteria in a wider area, irrespective of sediment disposal operations. All other criteria are met throughout the

whole monitoring area. The PCB concentrations found in mussels comply with the assessment criteria. Among the trace metals, lead concentrations exceeded the criteria in all mussel samples. The concentrations of PCB 118 and PCB 138 in the soft tissue of snails considerably exceed the recommended OSPAR criteria for mussels and fish in all parts of the monitoring area, whereas TBT concentrations meet the environmental assessment criteria (EAC) set by OSPAR [2]. However, the Hg contents in snails do not comply with the EQS of the European Water Framework Directive. The data of *L. limanda* confirm these results. In all parts of the monitoring area increased concentrations of PCB 118 (liver) were observed, and the Hg levels exceeded the EQS for all biota irrespective of dredged-material disposal actions.

Discussion: Increased concentrations of contaminants were observed in the fine-grained fraction of the sediments at the site of dredged-material disposal. Despite of this enrichment in the sediment, accumulation of contaminants in biota is not evident in the sessile filter-feeding mussels as seen by the homogeneous spatial distribution of contaminants their tissue at all sites of the monitoring area.. Exceedances of the recommended EAC occurred with PCB118 (in snail, fish, sediment), PCB138 (snail), and Pb (mussel) over the whole monitored area and in all samples, so that it can be assumed that these effects result from recent exposures e.g. fluvial input. Local bioaccumulation of organo-tin compounds and p,p'-DDD was determined only in the tissue of snails at the disposal site. Regarding the sediments, the exceeding EAC-levels of phenanthrene and benzo(a)pyrene can be attributed to the dredged-material disposal.. Nevertheless, two years after the termination of disposal operations, there is a significant tendency to decreasing contaminant levels, both in sediments and in biota at the disposal site.

References: [1] BfG (2011) Zwischenbericht 2009, Unpubl. Report BfG-1711, pp.224 [2] OSPAR (2009) Background Document on CEMP Assessment Criteria for QSR 2010 Publication Number: 461/2009: pp. 23