

Horizontal permeable reactive Barriers for contaminated Sediments in marine Environments

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Due to centuries of using waterways for industrial production and transportation of raw materials and goods, many rivers around the world are contaminated with organic pollutants. Soil samples show that the contamination reaches depths of up to two meters below the riverbed. High concentrated pollutants from the early years of industrialization are found far below, and more recent contamination is deposited closer to the surface. Remediation of these sediments is essential to prevent bioaccumulation and thus the entry of hazardous substances into our food chain.

Dredging is the most commonly used remediation method for contaminated rivers and harbours. However, it is energy intensive and requires dewatering and disposal of large amounts of contaminated soil. The decreasing landfill volume in many European countries or an already low landfill density in remote regions are factors for high costs. It is estimated that 80 % of the costs for the remediation measure are related to the downstream processes of dewatering and landfilling.

Analyses of the water body indicate that the concentration of contaminants increases significantly after dredging, as shown in Fig. 1. As sediments are stirred up, pollutants dissolve and increase the concentration of contaminants in the water body. Only after sediments have settled, the concentration decreases. Due to this sedimentation, however, a residual amount of pollutants always remains in the riverbed.

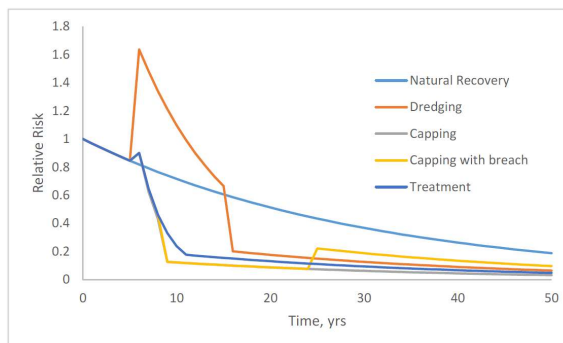


Fig. 1: Contamination spill of dredging, natural recovery and sediment capping [1]

As a supplement or alternative to dredging and dewatering measures, so-called “sediment caps” can be built. Materials that adsorb organic pollutants are installed over the contaminated sediments. Percolation of the pollutants with the groundwater into surface waters is thus prevented. With small amounts of activated carbon or organophilic clay, horizontal reactive barriers can be designed to ensure adsorption of the organic compounds over several decades. With the help of flux simulations, the required amount of reactive substances can be determined. The conference paper and presentation will cover the key aspects of designing and constructing a sediment cap with reactive geocomposites. Examples of sediment remediation projects from the U.S. and Australia are used to introduce the concept of horizontal reactive permeable barriers in marine environments.

References: [1] Reible, D. (2020) Managing the Physical, Chemical and Ecological Challenges of Sediments, HUESKER internal sediment meeting.