Sediment capping – an alternative to dredging of polluted sediments

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Introduction: Harbor sediments can be heavily polluted from industrial and urban sources on land leading to unacceptable risk to the recipient water body. Capping of polluted sediment can be an attractive option to dredging in areas where water depth is more than satisfactory for navigational needs. Capping is attractive because spreading of pollutants can be avoided both during dredging and re-deposition. The capping process poses requirements to the thickness of the capping layer as well as a good control of the operations during the establishment of the capping layer. The presentation explains the estimation of capping thickness (with the use of numerical simulation models) and the measurement of capping thickness from an actual capping operation.

Methods: A numerical model [1] [2] has been applied for simulation of capping operations carried out with moving barges. The velocity and dimensions of the barge are used as input to the simulations. Fig. 1 shows the technique used. Capping layer thickness was measured by sediment profiling imaging (SPI). A prism was penetrated into the surface of the capped sediment. An image of the sediment profile was captured with a camera inside the prism.

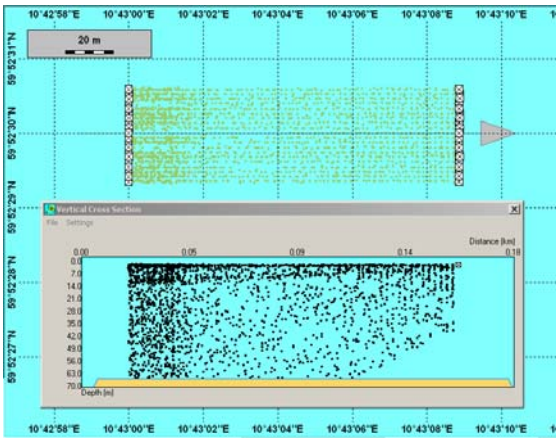

Fig. 1: Simulation of deposition from a moving barge. The model simulates the deposition of the capping material. Particles are released from 20 sources distributed along the barge, which is moving laterally (to the right). Bird's eye view and vertical cross section in the direction of the motion.

Results and discussion: The model was applied to a case in Norway (Oslo harbor area) where polluted sediments were dredged and then deposited elsewhere. On the top of the deposit, a capping layer with clean sediments was generated with the use of moving barges. For each barge deposit, the intention was to generate an 8 – 10 cm thick layer with clean sediment, in order to prevent spreading of toxic compound from the polluted sediment below. Fig. 2 shows a comparison between simulation results (full line) and measurements (squares) for a cross section through the deposited layer. The comparison is satisfactory. The actual thickness is however lower than 8 - 10 cm due to the presence of a fine particle fraction in the discharge that spreads in the water column before settlement on the sea floor, combined with the effects from the presence of ambient currents. The model can thus be used with confidence to predict the success of using moving barges for capping operations.

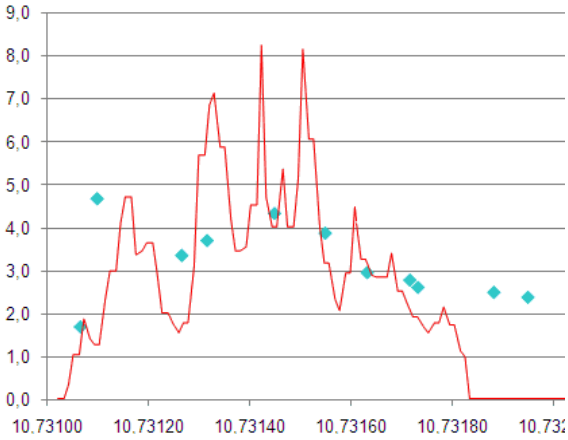

Fig. 2: Comparison between DREAM model results and measurement results. Vertical: thickness of capping layer in cm. Horizontal: Distance across the deposited capping layer on the sea floor in m.

References: [1] Singsaas et al (2008): Development of a risk-based environmental management tool for drilling discharges. Summary of a Four-Year project. *Integr Environ Assess Manag* **4**:171-176. [2] Rye et al (2008): Development of a numerical model for calculation of exposure to toxic and non-toxic stressors in water column and sediment from drilling discharges. *Integr Environ Assess Manag* **4**:194-203.