A model for calculation of sediment capping of polluted sediments

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Introduction: Due to discharges to sea from industrial activities over long periods of time in the past, some fjord sediment areas in Norway are still heavily polluted with toxic compounds (like dioxins, PAH's and heavy metals). Restrictions on consumption of sea food from such areas are expected for a long time ahead. One alternative for dealing with this problem is capping of the polluted sediment. This will prevent the polluted sediment to interact with the surface (bioactive) layers of the sediment.

The presentation deals with a numerical tool developed to predict the capping thickness on the sea floor and spreading in the water column caused by deposition of the capping material. Various alternatives for depositions can be simulated like dumping from moving barges or moving diffusor arrangements towed along the sea floor.

Methods: A numerical model [1] [2] has been applied for simulation of capping operations carried out with moving barges or diffusor arrangements. Fig. 1 shows the model results from a discharge of capping material through a diffusor arrangement towed across the sea floor. The discharge partly spreads in the water column and partly sinks down on the sea floor.
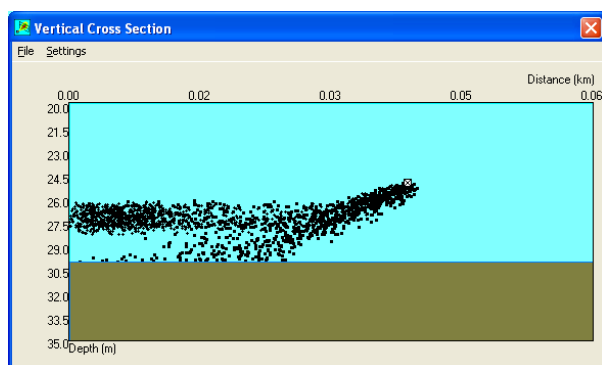
Fig. 1: Simulation of deposition of capping material through a hose from a moving barge. A diffuser arrangement has been mounted at the end of the hose. The model simulates the deposition of the capping material. The figure shows the particle material discharged and also sinking down on the sea floor. The diffuser is moving to the right.

Results and discussion: The model was applied to a case in Norway (Nedre Telemark fjord area) where polluted sediments are present due to previous industrial activities. One example of the results are shown in Fig. 2.
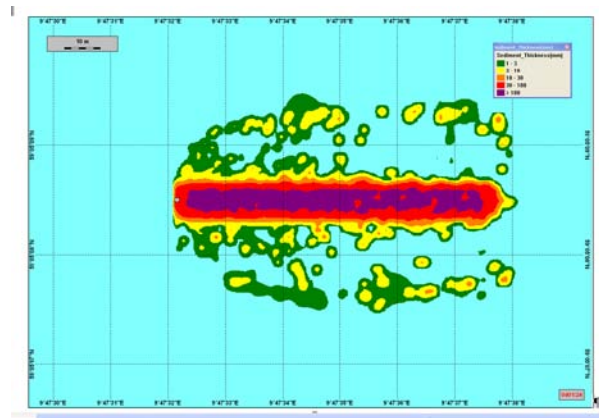
Fig. 2: Deposition of capping material on the sea floor. Example from a case where a diffuser is towed across the sea floor.

The results (resulting thickness deposited on the sea floor) can be controlled by measuring the depositions on the sea floor. Capping layer thickness was measured by sediment profile 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.

Results from the deposition calculations and the resulting thicknesses will be presented.

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.