MSc Thesis

Spreading of polluted sediment around the U-864 wreck

Analyses of currents and sediment dispersal during installation of a capping layer using a flexible fallpipe vessel.

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Analyses of currents and sediment dispersal during installation of a capping layer using a flexible fallpipe vessel .

by

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Abstract

Four kilometers west of the Norwegian island Fedje, mercury, leaking from the U-864 wreck, has highly polluted a seabed area of approximately 40 000 m^2. The bow section of the wreck is located on a stability critical slope of 15°. In 2016, Van Oord used a flexible fall pipe system to install a counter fill to stabilize the wreck and simultaneously cap a portion of the contaminated area. In the future, the Norwegian government plans to cap the complete area to prevent further dispersion of mercury. This research aims to gain more knowledge about the spreading of sediments during such an operation occurring under realistic hydrodynamic conditions. A more complete understanding of the process will allow for better risk assessment of future capping operations. To this end, the unique data set gathered during the counter fill project has been analyzed.

In order to predict extreme flow events, the bottom currents are decomposed. By decomposing the erratic velocity signal, tidal (25 %) and inter-tidal residual current (38 %) components are identified and understood. However, the driving force for the remaining intra-tidal part, which contains the highest current anomaly events, cannot be identified. Evidence is found for the occurrence of internal waves providing a possible explanation. Due to a lack of data, a quantitative prediction cannot be made. Consequently, the exact maximum currents at the site are unpredictable, but stayed below 0.4 m/s during the project.

During the installation work, high turbidity clouds have been measured. The origin is investigated by analyzing the particle size distribution and the mercury concentration of sediment samples; said samples are drawn from the capping material, the installed capping layer and sediment traps placed around the wreck. The findings indicate that the clouds are caused by a loss of clean material and are not from the contaminated seabed. This is supported by modelling the dispersal of clean particles from the flexible fall pipe. The promising results regarding the use of a flexible fall pipe for capping layer installation are not only applicable for the U-864 area but also for other polluted offshore areas.

Contents

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