

Overview of the assessment of contaminated marine sediments in the Nordic countries and their remediation

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Introduction: Since the beginning of the industrial era, regular, stochastic and diffuse discharges into the marine environment have led to long-term disruption of the biosphere. Around 1960-1970, global awareness of environmental pollution and its potential impact on our ecosystems increased, leading to new regulations and reduced release. Priority for characterization and remediation has been given to drinking water resources, though for the last two decades the focus has been placed on legacy contaminated sediments. This review aims to compare the status on contaminated sediments in Norway, Sweden, Finland and Denmark. It also studies the remediation techniques used and the reported efficiency, in order to identify the knowledge gaps and to provide advices for future remediation projects.

Methods: This review is carried out by a network of scientists in the Nordic countries that brings together expertise which allows for a unique comparison between the 4 countries. In fact, data about pollution and remediation can be hard to obtain because most official documents are written in Nordic languages, and information can be spread out between many government authorities. Typically, surveys and monitoring of remediation sites are not published in scientific peer review journals.

Results and discussion: This study shows the inequality of the importance and status of characterization surveys of contaminated marine sediment between the Nordic countries. While Norway has included contaminated sediments in the country's priorities since almost 30 years, Finland has not started any remedial action on polluted marine sediments.

Pollution sources are diverse, but as the forest industry is one of the main drivers of the economy in Norway, Sweden and Finland, it has also been responsible for important sediment pollution.

Dredging has been extensively used in Denmark for navigation purposes as its waters are shallow. Dredging has also been used in Sweden, Finland and Norway, mainly for maintenance of sailing depths. Capping has been conducted in a few sites in Norway, and it is under consideration in Sweden. Each method has different strengths and weaknesses including secondary effects, feasibility, cost and efficiency.

The characterization of the sites before remediation must be done as precisely as possible and to a wide extend in order to prevent any technical issues and to increase the probability of a sustainable, long-term remediation. There is not a lot of documentation on post-remediation monitoring, but this phase appears to be very important in order to evaluate the efficiency and improve the techniques.