

NGI's Strategic Institute Program

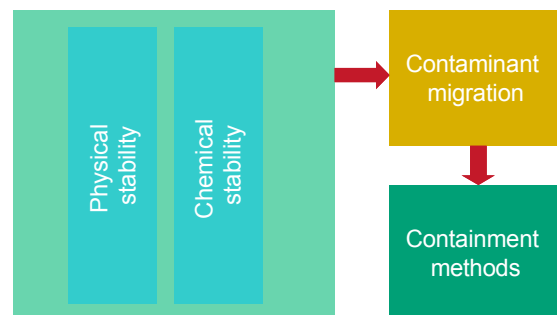
Stability of contaminated sediments

The research program will focus on advancing the state of knowledge on physical and chemical interactions in contaminated marine sediments to enable the determination of sediment stability, the prediction of contaminant migration and the design of long term containment methods.

The Research Council of Norway (RCN) has granted a five-year Strategic Institute Programme (SIP) "Stability of Contaminated Sediments" to the Norwegian Geotechnical Institute (NGI). The programme started in 2003 and will continue until 2007.

The main focus will be on the integration of knowledge on the physical and chemical interactions in contaminated sediments, with the following objectives:

1. Quantify the principal parameters determining the physical and chemical stability of contaminants in the sediment matrix.
2. Determine the contaminant migration resulting from engineering operations in contaminated sediments, like dredging, backfilling and construction works.
3. Establish design criteria for containment methods with a long term intrinsic stability and required safety.
4. Develop tools to evaluate efficiency of remediation methods.



Overview over the main areas of research in "Stability of Contaminated Sediments".

In Norway serious contamination of marine sediments has been found in fjords and coastal areas. This has resulted in restrictions on the consumption of fish and fishery products in many fjords. The Ministry of the Environment has identified the abatement of contaminated coastal, fjord and harbour sediments as a top priority for the coming years.

However, as a result of the general depth of Norwegian fjord systems, there is a limited need for maintenance dredging. Large-scale remediation will therefore be initiated based on environmental requirements only. Compared to natural processes, remediation and construction works will often exert extreme changes in physical/chemical conditions. These stresses might result in a deterioration of the present day situation over a defined period of time.

To be able to assess the efficiency of sediment remediation options, a proper understanding of the physical and chemical stability of the contaminants is required. This will allow a prediction of contaminant mobilisation and migration under various environmental stresses as well as support decisions on remediation priorities.

Research methodology

Three main areas of research identified are:

- Chemical and physical stability
- Contaminant migration
- Containment methods

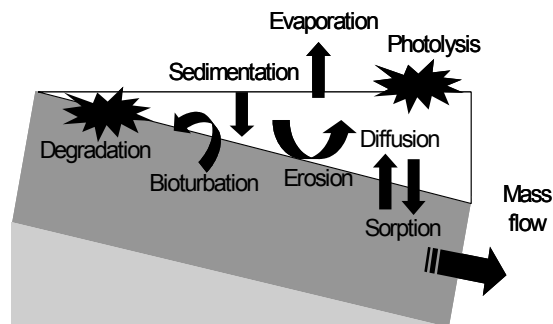
Chemical and physical stability research will form the theoretical basis for the programme principally through the use of laboratory scale tests and pilot studies with subsequent validation at established field sites.

Stability

The sediments at the water-sediment interface are often very soft and have a very “fluffy” nature. It is therefore difficult to determine a clear border where suspended solids becomes a loose sediment. To determine the stability of the contaminants present it is important to do an extensive characterisation of the sedimentary material, both physical and chemical. Dredged materials are usually even softer than in-situ material. Classical geotechnical characterisation methods are unable to determine the properties of these sediments which results in the use of extremely large safety factors when the bearing capacity is evaluated. In this research programme physical stability will be studied using various methods to determine sedimentation and consolidations rates as well as very low shear strength both under laboratory and field conditions.

Migration

High contaminant loads have resulted in increased levels of organic matter in near shore sediments giving anoxic conditions. The organic matter in the sediments effectively sorbs organic contaminants while the anoxic conditions stabilise heavy metals in sulphide complexes. At present there are few methods to predict the fraction of contaminants that can become available as a result of resuspension or other disturbances of the environmental conditions. Development of predictive tools for contaminant release is critical to quantify migration of contaminants. Laboratory and field methods will be developed to quantify these processes.



Main processes determining the contaminant loads in the aquatic environment

Containment

Remediation of contaminated sediments has often been based on removal, as a consequence of maintenance dredging of harbours and major waterways. Dredging material has mainly been stored in controlled disposal sites. Disposal can be in the aquatic environment with some form of physical barrier “Confined Aquatic Disposal” (CAD), near shore “Confined disposal facilities (CDF) or on shore. Capping has also been used as an in situ remediation approach. These methods have mainly been applied on an empirical basis and little is known about the critical factors in the confinement solutions and the long-term stability. This program will study long term containment stability using different cover constructions and natural consolidation conditions both in lab and field. In addition the chemical interaction between capping material and sediment will be studied.

Pilot study

A pilot study demonstration site will be established at Oslo Harbour, Bispevika/Bjørsvika. The contaminant profile in the sediments from Oslo Harbour represents typical urban harbour sediments. The study site is located at one part of the harbour which has been subject to heavy ship traffic, a former shipyard was located here and the river Akerselva, which has a number of former industrial sites upstream, enters into the harbour. This site will be used to determine in-situ conditions concerning transport and migration as well as the effect of engineering operations and containment solutions.

Contact: Gijs D. Breedveld, gbr@ngi.no

P.O. Box 3930 Ullevaal Stadion
N-0806 Oslo, Norway

Street address: Sognsveien 72, 0855 Oslo

www.ngi.sediment.no

Telephone: +47 22 02 30 00

Telefax: +47 22 23 04 48

E-mail: ngi@ngi.no

Internet: www.ngi.no

