Sediment remediation in Norway - national status and plans

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Outline

- Contaminated harbour sediments – Norwegian perspectives
- Sediment remediation – plans and projects
- Sediment remediation – environmental goals and alternatives
- Communicating risk
- Challenges

Norwegian harbour and fjord sediments

- Environmental setting
  - Low rate of sedimentation – high levels of contaminants
  - Organic rich sediments – anoxic conditions
  - Silled fjords – restricted deep water exchange
  - Small tidal amplitude (except of northern Norway)
  - Deep waters – limited need of dredging

Animal reworking of sediments
(photo: Hans Nilsson, NIVA)

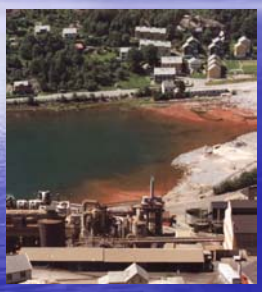
National status – sediment remediation

- A number of 17 sites have been assessed with respect to environmental risk
- A priority list of 9 sites is made with respect to remediation (risk based)
- Different levels of ambitions
  - MNR (monitor natural recovery)
  - Stop dispersal from hot spot sediments
  - Avoid user conflicts (restrictions on consumption of seafood)
  - Avoid ecological implications

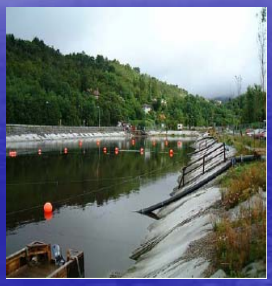
Completed full scale remediation projects in Norway

- Capping – Sørfjorden, Odda
- Dredging and near shore CDF – Haakonsvern, near Bergen

Capping 90.000 m2 of metal contaminated sediments in Sørfjorden, Odda (1992). Cost about 50 mill NOK



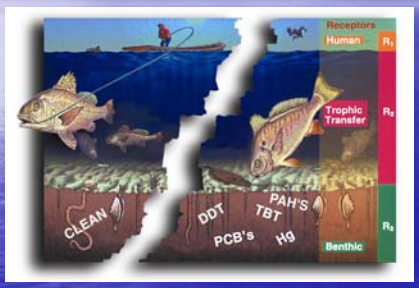
Deep water dredging of 60.000 m3 PCB contaminated sediment near a naval base (Haakonsvern) in 2003. Cost about 185 mill NOK (incl. near shore CDF)



Ongoing sediment remediation

- Dredging of 650.000 m3 harbour sediments in Oslo and deep water disposal (photo Statens Veivesen, Bjørvika project)

This is what it is all about
(illustration T.Bridges, USACE)



Environmental threats – facts or fantasy?

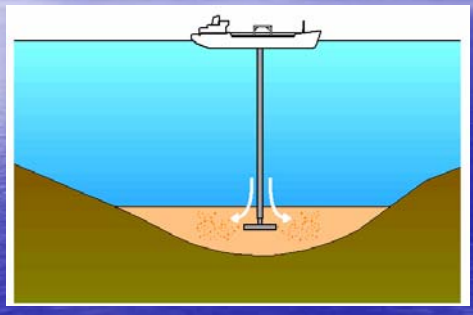
- Sediments as a point source – risk of erosion and dispersal (i.e. ship propellars, climatic changes, building activities)
- Human health risks – consumption of contaminated sea food, physical exposure during swimming /oral intake
- Ecological risks (toxicity, impact on biodiversity)
- Socioeconomic risks (harbour – and coastal zone development)

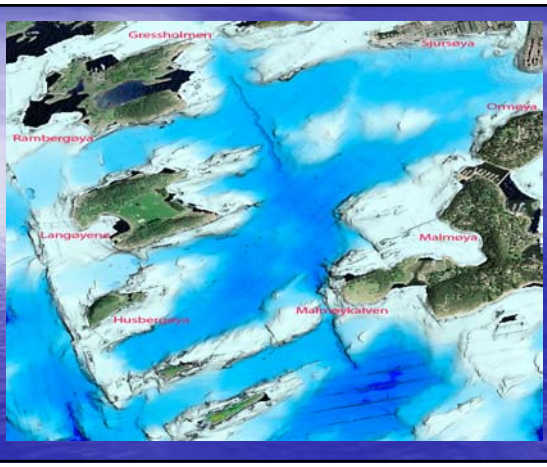
Dredging or capping?

Deep water disposal

- Natural low energy, low oxygen fjord basins
- Addition of brines to increase the density of the plume and to facilitate sedimentation
- Capping of the disposal site with 50 cm of sand

Disposal in Oslofjorden





The moral issue of capping

Sediment remediation and decision-making

- Decision-making in environmental projects is characterized by trade-offs between socio political, environmental and economic impact
- Comparison of non-commensurate criteria
- Sediment remediation in perspective
- The importance of stakeholder involvement (When? How?)

Sediment remediation in perspectives

- Comparing sediment remediation with end of pipe solutions, sewage treatment etc.
- Sediment remediation = reducing risks
- To make the decision process more transparent
- Secondary benefits for society
- Use of comparative risk assessment (CRA) and multi-criteria decision analysis (MCDA) – enlarges the scope
- Challenge: simplify the tools

Sediment remediation – environmental goals

- What do we achieve and when?
- Concentrations or effects?
- How do we communicate uncertainty?
- The importance of extensive monitoring – documentation of environmental improvement
- Consequences natural recovery
- Cost –efficiency
- Recipe: Do good science and be practical !

How much knowledge do we need?

"Management decisions must be made even when information is imperfect. There are uncertainties associated with every decision that need to be weighed, evaluated and communicated to affected parties. Imperfect knowledge must not become an excuse for not making a decision."

National Research Council, *A Risk Management Strategy for PCB-Contaminated Sediments, (2001)*

Main challenges

- How to set realistic goals which are economically feasible and environmental acceptable
- How to communicate risk and uncertainty
- How to document the effect of sediment remediation