

# Contaminated sediments at Ramsund Naval Base in Norway.

## Risk assessment and remedial action plan

**Harald Bjørnstad<sup>1</sup>, Eli Smette<sup>1</sup>, Svern Samuelsen<sup>1</sup>, Vidar Ellefsen<sup>2</sup>**

a) <sup>1</sup>Norwegian Defence Estates Agency (NDEA), P. O. Box 405 Sentrum  
N-0103 Oslo, Norway  
<sup>2</sup>Golder Associates AS, Vebjørns vei 5, N-3400 Lier, Norway

Phone: :+47 95 92 77 78  
E-mail:  
harald.bjornstad@forsvarsbygg.no

**Introduction:** The Norwegian Defence Estates Agency (NDEA) is an administrative agency subordinate to the Ministry of Defence. The agency's primary tasks relate to the planning, construction, administration, leasing and disposal by sale of defence estates and properties.

NDEA has been responsible for planning and follow up of mapping and remediation of contaminated sites and contaminated sediments at the Naval Base Ramsund in Northern Norway.

There are restrictions on fish consumptions because of high levels of PCB, and there is need for remedial action related to the contaminated sediments

**Methods:** At this stage sediment contamination has been mapped, and contaminated sites at the Naval base has been remediated. It was important to stop the sources for PCB contamination from landfills and contaminated areas onshore, before any remedial action was started regarding the sediments. For example was a big landfill excavated and removed from site.

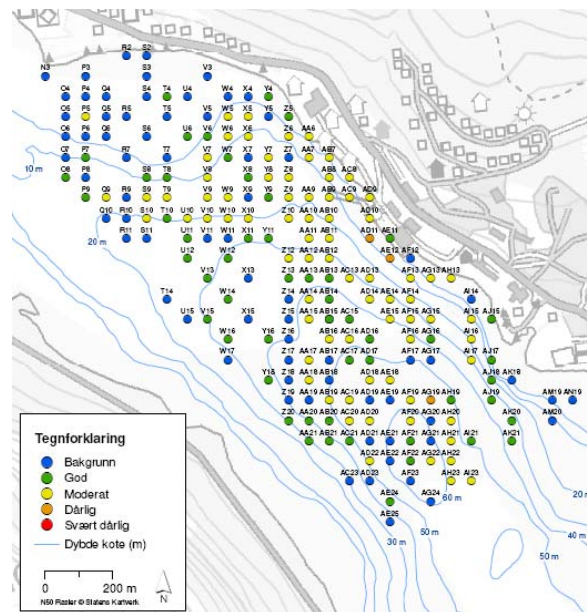
Sediments was sampled in a large area outside the naval base (appr 3 km<sup>2</sup>), within a grid of 60 m in the expected most contaminated area and 180 m in expected less contaminated area. 427 sediment samples were taken for analysis of PCB.

The seabed was also mapped with ROV, with photos of all sediment sampling stations and video along profiles with equal distance as the sampling grid. Measurements of currents at different depths, was also taken.

Based on the results from analysis of sediment samples and toxicity tests, risk assessments were carried out. The new Norwegian risk assessment tool for sediments, by the Norwegian State Pollution Control Authority was used, and this proved to be an efficient tool.

Based on risk assessment, areas with unacceptable risk for continued contamination of shells and fish was identified, and also areas where it was a

unacceptable risk for transport of contaminated sediments to other non contaminated areas.



**Fig. 1:** Sediments sampling points at Naval Base with PCB-concentrations

**Results:** Fig 1 shows the levels of PBC contamination in the sediments, and that the highest levels of contamination are found just outside the Naval base.

In addition to mapping contamination, toxicity test has been carried out on 20 sediment samples. Only two of these test showed higher levels of toxicity than the public acceptance levels, and the toxicity was in general low.

Fish and shells have also been sampled for PCB analysis, and show lower levels of PCB than samples taken in 2002. This indicates that remediation of the PCB-contaminated sites on land, had a positive effect, but that there is still a need for remediation of the most contaminated sediments.

**Discussion:** The risk assessment together for samples of shell and fish shows that there is a need for remediation of contaminated sediments.