Is the conservative turbidity limit the most environment-friendly approach? A review of the use of turbidity measurements in remediation projects

Håkon Austad Langberg[1], Anita Whitlock Nybakk[1], Gunvor Baardvik[2]

[1]NGI, Høgskoleringen 9, Trondheim, Norway
[2]NGI, Sognsveien 72, Oslo, Norway

Phone: +47-47242944
E-mail: hal@ngi.no

Introduction: Turbidity measurements can be used to estimate the amount of suspended sediments. Some ecosystems or infrastructures can be harmed by too high turbidity, due to the elevated particle concentration. In areas with polluted sediments, resuspension is related to the transport of pollutants in several ways, three pathways are listed below. 1) Diffusion of contaminants from sediments increases with increasing surface area, sediments suspended as particles have much greater surface area compared to sediments at the sea floor. 2) The number of biotic uptake routes increases when polluted sediments are both on the sea floor, and suspended in the water column. 3) Transport of particles with high amounts of contaminants out of the remediation area.

To control levels of turbidity during the execution phase, limits of turbidity have been set in different projects in Norway. Limits, which a contractor is allowed to work within. These limits are defined with a time interval and a turbidity level (e.g. 10 NTU over background in 20 min). The limit can be related to the possible harmful effect of an elevated particle concentration, or one wants to limit the transport of pollutants. The latter is more common.

NGI has worked with several different remediation projects in Norway, and has made environmental budgets before, and accounts after, the remediation. There are several factors that are important in these budgets, but turbidity level and time are two of the most important ones. The turbidity limit may affect the progress in a typical dredging and capping project. A low turbidity limit will ensure a low rate of contaminant transport, but can be time consuming due to the need for many stops and careful work to keep the turbidity at a very low level. It is possible that the delaying effect of low turbidity limits causes an overall increased release of contaminants in some projects, as illustrated in figure 1.

NGI wants to summarize our experiences in a research project, and find out if it is time or level of turbidity that is the most controlling factor in transporting pollutants from a remediation area.

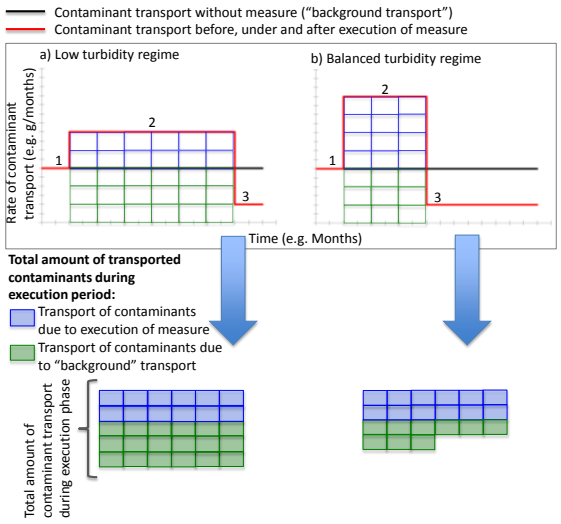

Fig. 1: Simplified example of contaminant transport during the different phases of a remediation project, (1. before execution, 2. during execution, and 3. after execution of measure) under two different turbidity regimes; a) a conventional conservative turbidity regime that is time consuming due to the need for many stops and careful work to keep the turbidity at a very low level, and b) a balanced turbidity regime where the remediation is executed fast.

Methods: We are currently reviewing data from several Norwegian remediation projects, especially data from the clean-up project in Trondheim harbor, where the contractor was working under two different turbidity limits. In addition, we are currently performing literature and case studies on the effect of turbidity on biota.

Results: The quantitative effect of turbidity level on progress in the remediation project in Trondheim will be presented, together with data on contaminant transport and turbidity from other projects, as well as effects of turbidity on biota. We will discuss site-specific factors, and use this to address several aspects that are important to take into account in implementation and enforcement regarding turbidity monitoring, for a more efficient, cost-effective, and environment-friendly execution of future remediation projects.