On-site analyses as a decision support tool for dredging and sustainable sediment management

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Introduction: Beneficial use of dredged sediments is based on their potential as alternative resources, either in a marine (harbours) or inland (waterways) context. They can be considered as bulk material for industry needs, which implies addressing their current waste status or end-of-waste constraints. They also can be an integral part of beneficiary use projects using sediments as a bulk component, including civil engineering and landscaping (Building with Nature, Engineering with Nature). The EU-funded project SURICATES (InterReg NWE) develops such pilot projects with a focus on climate change mitigation: coastline defence, flood protection and regeneration. The EU-funded project VALSE (InterReg FWVl) develops pilot projects with a focus on sustainable transport.
When dredged sediment is used as a bulk material, its acceptability is based on a continuous control of its properties. On-site analyses allow pre-dredging detail mapping at a denser scale than laboratory ones; monitoring dredgings during operations and during processing; and controlling their properties at the implementation site.
When dredgings are part of a larger beneficial use project, on-site analyses facilitate first the baseline survey and the sediment source characterisation. Sediment load continuous monitoring allows a fast detection of contamination spots and their adequate management. Target site survey by on-site instruments allow end users and communities to check themselves the contamination level, hence better acceptance.

Methods: On-site analyses comprise dredged sediment analyses, both for building properties and environmental compliance; soil and sediment analyses at receiving sites; surface and groundwater, either for impact assessment or for works monitoring.
Most often, sediment and soil elemental analyses are performed by pXRF (Fig. 1), minerals are analysed by FTIR, organics by GC and water monitoring is based on multiparametric probes (pH, EC, turbidity,...).

Fig. 1: On-board pXRF analysis of dredgings.

Results: The monitoring strategy of SURICATES pilot projects (Port of Rotterdam, Bowling and other Scottish Canals sites, [1]) and VALSE (Saint Omer, [2]) was based on pXRF and probe analyses of the source sites, the baseline surveys of receptor sites, and will include a post-pilot monitoring survey. In most cases, surveys confirmed known trends but provided better detail and sensitivity.

Discussion: Most analyses obtained on-site cannot be used for compliance, but they are suitable for decision support. They provide immediate results – usually within minutes – and allow dynamic or adaptive sampling strategies, as well as real time operational decisions. Confirmation by laboratory analyses is required for validation, but on-site sample screening for laboratory analyses improves their efficiency.

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References: [1] Lemière et al. (2019), Baseline monitoring at a pilot site for sediment reuse. Bowling, Scotland. *SedNet Conference, Dubrovnik*.
[2] Laperche et al. (2019) Environmental monitoring at a sediment source site to qualify for beneficial use. *SedNet Conference, Dubrovnik*.