Turn-key technology to monitor and treat contaminated sediment *in situ*

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Introduction: A turn-key technology was developed and validated to map, monitor and treat contaminated sediment in situ. A patented floating engine that can navigate both water and land surfaces was built and optimized to scout and treat polluted sediments of rivers, waterways, lakes and harbors. Taking undisturbed water and sediment samples with cm-precision is now possible, thanks to a modified stainless steel sediment core sampler firmly mounted onto a hydraulic boom, wherein the sampling tubes can easily be inserted and firmly fixed. Thanks to an advanced 3D-positioning system, cm-precise sampling in x-y-z space becomes possible through a fully controllable process, including sampler positioning, opening and closing of pneumatic valves to retain the sediment, local freezing of sediment cores, sample extraction and data logging.
The floating engine further allows to inject and distribute remediation products into sediments for accurate and efficient in-situ pollution abatement. Chemical and biological amendments can be heated, mixed, dosed and injected in sediments up to 18 m below water level with cm-precision to treat oil spills, chlorinated organic compounds or other persistant organic pollutants. A range of highly effective injectable products has been developed and validated in full scale remediation projects , including a 70 hectare contamined sediment in an accumulation basin from a hydroelectric power station. In this presentation we will explain and discuss the floating remediation engine, the (bio-)chemical amendments that can be applied and a full-scale case study.

Methods: A floating remediation engine was developed according to Figure 1. A precision position system was installed and included an RTK-GPS positioning system, on-board positioning hardware and software, and a sonar system for bathymetric survey.

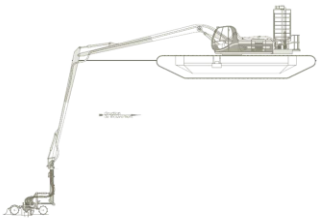

Fig. 1: *Cross-section of the floating remediation engine.*

In-situ chemical reduction (ISCR) of chlorinated POPs was allowed through the application of a bimetallic catalyst system, driving the following chemical reactions:

$Fe(0) + 2\,H^{+} \rightarrow Fe\,(II) + H_2\,(pH < 7)$
$R\text{-}Cl + H_2 + cat \rightarrow R\text{-}H + H\text{-}Cl + cat$

Results: A full-scale sediment characterization and remediation project was executed at the site of the hydroelectric power station of Coo, owned by GDF Suez - Electrabel. Representative sampling points were (evenly) spread over the 70 hectare polluted sediment area. Remediation objectives were reached.. An accurate sampling and monitoring methodology was developed. The catalytic reaction pathway for dechlorination was studied in *Dien et al. [1]*

Discussion:
Remediation objectives were reached, through optimization and application of an innovative turn-key in-situ approach. Transport or dredging of contaminated sediment could be omitted, further increasing sustainability. Complete dechlorination reaction pathways of POPs were studied.

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References: [1] Nguyen Thanh Dien et al. (2013) *J Haz Mat* **252-253**:83-90.