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► To cite this version:

Faycal El Fgaier, Arjan Wijdeveld, Bruno Lemière, An Janssen, Sinead Tangney, et al.. Management decision process of beneficial reuse of marine sediments in civil engineering applications. SedNet Conference 2015, Sep 2015, Krakow, Poland. 2015. <hal-01185074>

HAL Id: hal-01185074

<https://hal-brgm.archives-ouvertes.fr/hal-01185074>

Submitted on 19 Aug 2015

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Management decision process of beneficial reuse of marine sediments in civil engineering applications

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Introduction: The management of dredged sediments is an increasing issue for harbours and local authorities. Consequently, contaminated sediments are the subject of intense technology development, such as beneficial reuse or in situ treatment. However, current decision analysis approaches, such as comparative risk assessment, benefit-cost analysis, and life cycle assessment, do not offer a comprehensive approach for incorporating the varied types of information and multiple stakeholder and public views [1].

In this context, the EU Interreg-funded CEAMaS project promote the beneficial re-use of marine sediments in civil engineering applications, in a sustainable, economic and socially acceptable manner.

The objective of this paper is to support management alternatives for dredged marine sediments based in two main criteria: The first one is compliance to legislation related to sediment management, which differs in each country. The second criteria are the physical, mechanical and chemical properties of dredged marine sediments, which define the possible civil engineering applications and other reuse options according to national legal frameworks and standards. It allows also the selection of a treatment process (if needed) and to determine other reuse operational options.

Methods: The methodology of this study is based on the development of a database on the legislations related to sediment management in CEAMaS project partner countries (Ireland, France, Belgium and the Netherlands), and on the mechanical, physical and chemical requirements of various civil engineering applications (such as infrastructure, coastal protection works or as a building material, ...).

An experimental work is then carried out at the laboratory scale. Dredged marine sediments from different locations are characterised, according to various national standards and common characterisation methods for sludge properties.

Engineering suitability and environmental compliance are both addressed for all samples by each partner according to its national methodology. This methodology allows a comparison of each sediment properties with the reference values of each national legislation. Therefore, it identifies the potential civil engineering applications for various sediment types, and the different possible treatment processes (if needed).

Results and discussion: The first samples show contaminant values in excess of national standards but not necessarily for the same contaminants for all countries. They show a large range of mineral and engineering properties, reflecting their sedimentological and geographic origin. This leads them towards different possible applications.

Based on the database and laboratory works, a tool is being developed for the application to different dredged marine sediments. This tool is based mainly on regulatory and technical aspects for the management alternatives of sediments, by connecting sediment's composition and characteristics with reuse application requirements and sludge treatment procedures

In the CEAMaS project, the economic feasibility and the social aspects are also considered for re-use options of marine sediments in civil engineering applications. A Multicriteria Decision Analysis framework will be developed for guiding individual decisionmakers to choose the best reuse option of sediments, depending on the criteria of interest.

Acknowledgement: This project was supported by the European Regional Development Funding through INTERREG IV B.

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[1] Linkov I, Satterstrom FK, Kiker G, Seager TP, Bridges T, Gardner KH, Rogers SH, Belluck DA, Meyer A. Multicriteria decision analysis: a comprehensive decision approach for management of contaminated sediments. Risk Analysis. 2006 Feb; 26(1): 61-78.