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Abstract

In order to improve decision-making for soil and groundwater remediation, a multi-criteria assessment (MCA) method for comparing the sustainability of remediation alternatives has been developed. In addition to assessing cost and effect of remediation, the model considers environmental and societal impacts and involves stakeholders in the derivation of criteria weights.

The MCA method was developed using a hierarchical structure and includes five main decision criteria: Remedial effect, remediation cost, remediation time, environmental impacts and societal impacts. Environmental impacts and societal impacts are subdivided into a number of sub criteria (see Figure 1). The environmental impacts cover mainly secondary impacts to the environment caused by the remedial activities and are assessed in a life cycle assessment (LCA). The societal impacts are to a large extent local impacts and are mainly assessed in a more qualitative manner on a scale from 1-5. The performance on each main criterion is converted to a score and an overall score is obtained by multiplying each score by a criteria weight.

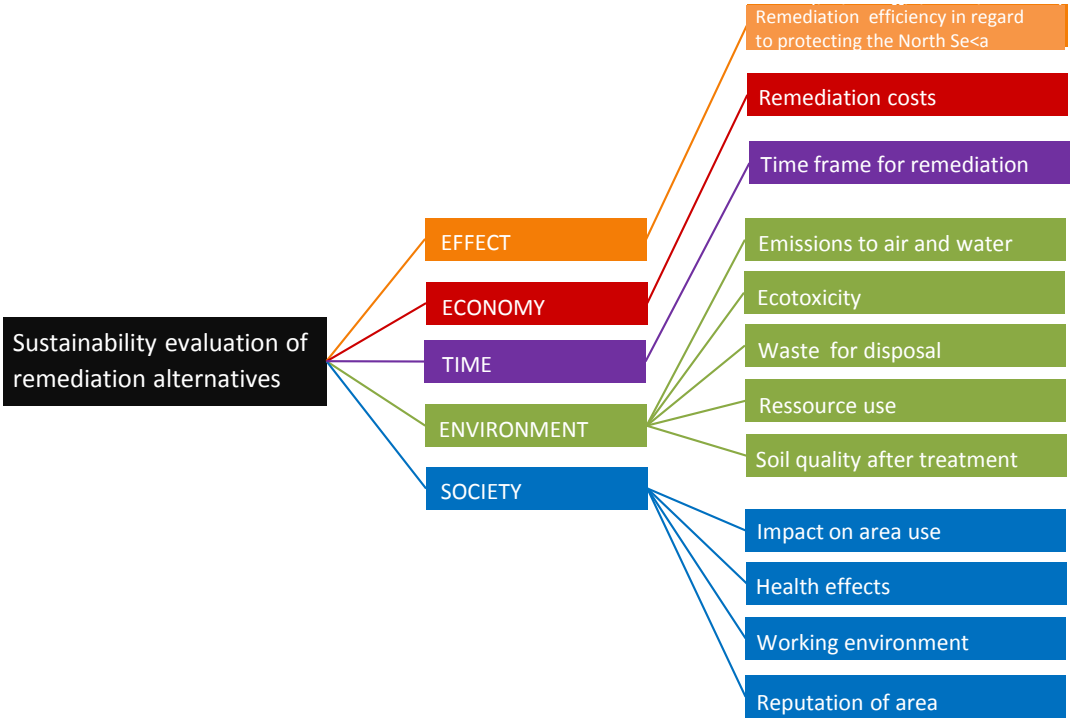

Figure 1. Schematic of the hierarchical structure of the multi-criteria assessment method

To illustrate the use of the method it was applied to assess five management scenarios for the Groyne 42 site in Denmark. Groyne 42 is one of the largest contaminated sites in Denmark with an area of 20,000 m^2 and is located on the west coast of Jutland. In the 50s and 60s large amounts of waste, mainly residues from pesticide production, was disposed of at the site. In the 70s and 80s, parts of the contamination were excavated, but the deeper contamination was not removed and contains approximately 100 tons of contaminants. In 2006 a sheet pile wall was installed around the contaminated site in order to prevent the transportation of the contaminants to the North Sea.

The Central Denmark Region is responsible for the management of the site and have proposed five different management scenarios: (1) Excavation of the site followed by soil treatment, (2) Excavation of the site followed by disposal, (3) In situ alkaline hydrolysis, (4) In situ steam enhanced extraction and (5) Continued encapsulation of the site (no removal of contaminants).

The five management scenarios were assessed using the MCA method described above. The various impacts were weighted using a stakeholder panel who assessed the importance of the five main criteria (Effect, Economy, Time, Environment and Society) in relation to each other. The stakeholders gave the highest weighting to the remedial effect of the methods and to the societal impacts.

The developed multi-criteria method provides useful insight into how the remediation scenarios compare to each other in terms of remedial effect, cost, time use and external impacts to environment and society. In addition, it offers a possibility for summing the weighted criteria scores in order to identify the most sustainable remediation option. The final results of the application of the multi-criteria method to the Groyne 42 site will be presented at the conference.