LCA of Aboveground Bioremediation of Diesel-impacted Soil

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Primary and secondary impacts associated with bioremediation of diesel-contaminated sites were assessed using a life cycle assessment (LCA). The case study was the remediation of 8000 m^3 of subsurface soil impacted with an average of 6145 mg of diesel fuel/kg soil during a two year period. Two scenarios were compared; the construction of a single-use treatment facility in the vicinity of the site or the use of a permanent treatment centre that can accept 25000 m^3 soil/year. Moreover, since bioremediation is never 100% efficient, different efficiency scenarios, including the transportation of partially treated soil to landfill were analyzed. The primary impact of residual soil contamination was determined by developing a specific characterization factor (ecotoxicity and human toxicity categories in the EDIP method) based on the toxic components of diesel.

One major observation was the fact that the soil itself is responsible for an important fraction of the system's total impact, suggesting that it is beneficial to reach the highest level of remediation. The reutilization of the treatment facility is also an important issue in the overall environmental performance of the system. In the case of a single-use treatment center, the analysis showed that site preparation and closure were the two major contributing stages to the overall impact, mainly due to the bulk waste impact category. This significant contribution is explained by the asphalt production, paving and landfilling. Results indicated that off-site transport and the biotreatment process did not contribute notably to the level of environmental impact. The use of a permanent treatment centre is preferred since it allows a significant decrease of the remediation impacts**.** However, for isolated sites (away from a permanent treatment centre for a distance greater than 200 km), it should be more beneficial to treat the soil on site.

LCA was found to be an efficient tool to manage contaminated soil in a sustainable way. However, because of the major contribution of soil residual contamination, additional spatial and temporal data should be collected and integrated in the substance characterization factors.