Using Site Specific Life Cycle Assessment to Support a Contaminated Site Management Decision

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An LCA was used as a tool for managing the remediation of contaminated sites. The study was performed at an Aluminium production plant where four remediation management options were assessed for the remediation of existing aluminium processing waste landfill site. Three of the studied options were active remediation methods (requiring excavation and treatment of the waste) while one consisted in a passive *in situ* remediation method (leaving the source in place). The (eco)toxic impacts resulting from the presence of the pollutants in the soil (primary impacts) and impacts generated by remediation activities (secondary impacts) were compared.

To improve the reliability of the primary impacts assessment, site-specific data from hydrogeological, geochemical, and microbiological characterization were used. A fate and transport model was also used to simulate the evolution of groundwater contaminant. The resulting concentrations were introduced in the comparative LCA. For the Life Cycle Impact Assessment (LCIA), the EDIP methodology was used.

The results revealed a too large dominance of the (eco)toxic impacts associated with the presence of *in situ* pollutants. This was explained by the fact that the EDIP method was not well adapted for the evaluation of primary impacts. Consequently, the level of the assessment of ecotoxicity was improved. For this purpose, a new ecotoxicity characterization model was developed, which 1) differentiated freshwater and seawater, 2) considered the sediments ecotoxicity category, and 3) excluded the acute ecotoxicity category. The introduction of the primary impact assessment and the integration of an appropriate characterization model in the LCA study has then allowed to identify the optimal scenario according to local (eco)toxicity and to global environmental load.