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Sustainability Assessment Tool for the Selection of Optimal Site Remediation Technologies for Contaminated Gasoline Sites

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Abstract : Life cycle assessment (LCA) is a powerful tool established by the International Organization for Standardization (ISO) that can be used to assess the environmental impacts of a product or process from cradle to grave. Many studies utilize the LCA methodology within the site remediation field to compare various decontamination methods, including bioremediation, soil vapor extraction or excavation, and off-site disposal. However, with the authors' best knowledge, limited information is available in the literature on a sustainability tool that could be used to help with the selection of the optimal remediation technology. This tool, based on the LCA methodology, would consider site conditions like environmental, economic, and social impacts. Accordingly, this project was undertaken to develop a tool to assist with the selection of optimal sustainable technology. Developing a proper tool requires a large amount of data. As such, data was collected from previous LCA studies looking at site remediation technologies. This step identified knowledge gaps or limitations within project data. Next, utilizing the data obtained from the literature review and other organizations, an extensive LCA study is being completed following the ISO 14040 requirements. Initial technologies being compared include bioremediation, excavation with off-site disposal, and a no-remediation option for a generic gasoline-contaminated site. To complete the LCA study, the modelling software SimaPro is being utilized. A sensitivity analysis of the LCA results will also be incorporated to evaluate the impact on the overall results. Finally, the economic and social impacts associated with each option will then be reviewed to understand how they fluctuate at different sites. All the results will then be summarized, and an interactive tool using Excel will be developed to help select the best sustainable site remediation technology. Preliminary LCA results show improved sustainability for the decontamination of a gasoline-contaminated site for each technology compared to the no-remediation option. Sensitivity analyses are now being completed on on-site parameters to determine how the environmental impacts fluctuate at other contaminated gasoline locations as the parameters vary, including soil type and transportation distances. Additionally, the social improvements and overall economic costs associated with each technology are being reviewed. Utilizing these results, the sustainability tool created to assist in the selection of the overall best option will be refined.

Keywords : life cycle assessment, site remediation, sustainability tool, contaminated sites
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