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Sustainability Considerations for 1,4-Dioxane Treatment Technologies

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Background/Objectives. 1,4-Dioxane (DX) remediation is challenging due to its physiochemical properties and low target treatment levels. As such, applications of many traditional remediation technologies have proven ineffective. There are a number of promising DX remediation technologies that could potentially be developed for successful application to groundwater restoration. Sustainable remediation is an important consideration in the evaluation of remediation technologies. It is critically important to consider sustainability when new technologies are being applied or new contaminants are being treated with traditional technologies. There are a number of social, economic, and environmental drivers that should be considered when implementing DX treatment technologies. By including sustainability into technology evaluations and implementation plans, decision makers can be more informed and the results of remediation are likely to be more effective and beneficial.

Approach/Activities. We evaluated sustainability by considering the cradle-to-grave impacts of the chemicals, energy, processes, transportation, and materials used in various groundwater treatment technology approaches. It is not possible to rate technologies as more or less sustainable because each application is context specific. However, comparative analysis of sustainability factors is valuable to allow practitioners to assess remedial approaches in the context of their specific application. For each demonstrated DX treatment technology, we utilized one or more of the available sustainable remediation frameworks, guidance documents, footprint assessment tools, life cycle assessment (LCA) tools, and best management practices to evaluate pros and cons of each technology, from a sustainability perspective.

Results/Lessons Learned. This presentation includes an overview of sustainability usage in technology selection, identifies sustainability impacts related to technologies used to treat DX, provides several approaches to assess sustainability impacts, and summarizes potential sustainability impacts related to promising treatment technologies. Some of the applicable technologies, particularly in-situ biological processes, have limited existing field-scale applications and may still be considered "under development." However, their lower sustainability footprint suggests they be given consideration during the selection process. While the technologies evaluated appear promising, there is opportunity to use sustainability as an innovation engine to develop more sustainable treatment technologies.