

Use of a value-based model to assess residential and ecological reuse of Superfund sites

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Historically, a chief objective with respect to the management of contaminated properties, including Superfund sites, has been the remediation of contaminated groundwater, surface water, soil, or air. After the sites have been cleaned up and no longer pose a risk to human health or the environment, however, the land often remains barren and unused. Reframing the objective from clean up to *reuse* has important implications for the property's redevelopment potential and the optimal remediation strategy.

In determining the best course of action, an understanding of the key factors influencing redevelopment is essential. In the past, the majority of Superfund sites have not been reused. Of the sites that have been redeveloped, most have been slated for reuse as commercial property. Traditionally, ecological reuse has not been a consideration. To achieve the best possible reuse potential of a site, all alternatives, including ecological reuse, must be examined and valued.

We developed a value-based model to support decision-making in the design of reuse options at a Superfund site. In our conceptualization of this value-based model, we considered both the residential (housing development) and ecological (pineland) potential of an abandoned landfill. The study site was Emmell's Septic Landfill located in a suburb of Atlantic City, New Jersey. Contamination of groundwater and soil by volatile organic carbon compounds at this 38-acre site originated from the disposal of septic, municipal, and industrial wastes. The site was added to the National Priority List in 1999, and since that time an emergency removal action at the site has eliminated the most highly contaminated soil. Our research efforts involved constructing and parameterizing a value-based model to consider two contrasting reuse options and four different remediation strategies. The remediation methods we considered for soil were excavation and phytoremediation, and the techniques considered for groundwater were pump-and-treat and surfactant injection. Our model quantified the costs and benefits of the different reuse alternatives, including soil and groundwater remediation costs, site redevelopment costs, and benefits provided by ecosystem services and residential development. Annual approximations of the net benefits were discounted over an estimated useful life to arrive at a net present value for each combination of reuse and treatment regimes.

The residential reuse alternative produced private and public benefits largely based on revenue generation for the owner, taxes for the municipality, and improved infrastructure for the community. The ecological reuse alternative produced public benefits as a result of carbon sequestration, wildlife habitat, and aesthetic value. Based on the initial results of the model, the optimal reuse option for Emmell's Septic Landfill was determined to be as a pineland. In our initial modeling efforts, carbon sequestration was the largest source of value in the ecological reuse alternative. Our findings are significant because (1) the value-based model provides a tool for understanding the quantitative influences affecting reuse of a site, and (2) the results of the model provide a case for ecological reuse of Superfund sites when the value of ecosystem services is considered. This type of model can be used at other Superfund sites, such as those in Virginia, to determine redevelopment opportunities for contaminated sites. Furthermore, by focusing on the reuse goals of a site, remediation of contaminated groundwater, surface water, soil, or air can be tailored to achieve the most cost-efficient clean up of contaminated properties.

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