

# Intergenerational Cost Estimates: Challenges and Solutions for Long-Term Cleanup Decision Making

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**Background/Objectives.** Site complexities, such as back-diffusion from a low permeability matrix and inability to identify residual sources at complex sites, typically drive cleanup time estimates. Cleanup times for complex sites typically range from several decades to centuries. Our industry alternative evaluation processes used to screen and select alternatives were not designed with intergenerational remedies in mind. The objective of this paper is to explore the cost-estimating challenges for long-term cleanup projects and provide recommendations for framing these cost estimates.

**Approach/Activities.** A survey of decision documents for complex sites was completed to assess how costs were framed for long-term cleanup projects. Industry guidance was surveyed to evaluate recommendations for preparing long-term cost estimates. The trend in discount rates, going back nearly 40 years, was evaluated to highlight variability over time. The parameters for using a cost-effectiveness analysis and benefit-cost analysis were evaluated for their impacts on cost estimates. Long-term uncertainties, such as the societal value of cleanup over the life of the project and advances in technology are assessed for their potential impact in how the cost estimate is qualified. Additionally, a project scenario was evaluated that explored numerous scenarios based on different cleanup time estimates and discount factors to highlight how different cost-estimating approaches could lead to different conclusions on life-cycle cost estimates.

**Results/Lessons Learned.** Most long-term cleanup decision documents surveyed used a 30-year cost estimate as a basis, even though most sites would require more time to complete and some cleanup time estimates exceeded 100 years. Several important cost-estimating guidance sources were identified but do not fully address the challenges of developing long-term cost estimates for cleanup sites. A model is presented to help decision makers understand the trade-off between costs today and benefits in the future. The project scenario shows a “tipping-point” in decision making depending on the assumptions used in the cost estimate. Based on these findings, recommendations on how intergenerational cost estimate should be prepared are provided. Additionally, recommendations on integrating adaptive site management attributes (e.g., future advances in technology, changing real costs of completing long-term cleanups) to address future cost uncertainties will also be presented.