Geospatial Methods for Optimization Questions in the Project Life Cycle Stages

Geospatial methods can be applied across all project life cycle stages: release detection, site characterization, remediation, monitoring, and closure. Geospatial methods can be used in conjunction with traditional statistics to address environmental data that are often biased, clustered, and spatially correlated.

Common questions related to optimization in each stage of the project life cycle are presented below, along with applicable methods to address each question. The methods are presented in increasing order of complexity, from simple methods to more complex methods to advanced methods. Discussions of these methods are included in the Methods section.

Table 2 summarizes the optimization questions for each stage of the project life cycle; some questions apply to more than one life cycle stage.

Table 2. Optimization questions in project life cycle stages

General Topic	Specific Question	Release Detection	Site Characterization	Remediation	Monitoring	Closure
Plume Detection and Estimation	Do various detected concentrations represent an actual plume?	X				
Trend Maps	Are there significantly different concentration trends in different parts of the site?	X				
	If there are changes occurring in the plume, what is the spatial distribution of the temporal concentration trends across the site?			X	X	X
Estimating Average Concentrations	What are the average concentrations for different chemicals and how may they be changing over time as an indication of a release?	X				
	What is an estimate of the average concentration of a contaminant for any medium?		X	X		
Hot Spot Detection	Are there hot spots of interest at the site?	X				
	How can geospatial methods help with hot spot detection and delineation?		X			
Sample Spacing	What is appropriate sample spacing, considering spatial correlation?		X			
Interpolation	How can a representative interpolation (contour map) of results for any medium be prepared?		X			
Estimating Concentrations Based on Proxy Data	How can a large amount of inexpensive data be used to improve interpolation of other data?		X			

Category	Question					
Estimating Quantities	How can an estimate of quantities (for example, mass or volume of media) be developed?		X			
Background Estimation	How can background concentrations be estimated when working with spatially correlated data?		X			
Quantifying Uncertainty	How can geospatial methods help quantify uncertainty in the definition of a contaminated area needing further work, for any medium?		X			
Plume Change/Attenuation Over Time	How are the plume intensity and boundaries changing over time?			X	X	
	How can the plume attenuation over time be verified?					X
Evaluating Remedial Success	Has the remediation met remedial goals?			X		
Remedial Action Optimization	How can the ongoing remedial action be optimized?			X		
Future Data Prediction/Verification	Can geospatial methods support the prediction or verification of site conditions?			X		
Plume Intensity and Extent	What is the intensity and extent of the current plume?				X	
Monitoring Program Optimization	How can geospatial methods help optimize a monitoring program?				X	
	How can geospatial methods help to determine if the monitoring program is adequate for closure?					X
Attainment of Closure Goals	How can the remaining plume intensity and extent be verified and the likelihood that all of the plume has met a specific closure goal or standard be assessed?					X