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Remedial Action Optimization

The general topics of Evaluating Remedial Success and Future Data Prediction/Verification are related to Remedial Action Optimization (see General Topics, Table 2). The results of geospatial interpolation can be used to directly to help optimize remedial programs or as input into other analytical tools, such as groundwater flow and contaminant fate and transport models. This approach includes using geospatial methods to support the feasibility study, remedial design, and remedy implementation. This approach also includes evaluating remedial progress/success, remedy modifications, and remedy completion status.

Understanding the Results: ▼*Read more*

The results of geospatial interpolation can be used to optimize the following remedial program tasks:

- Delineate the target treatment zone, which can be represented by a soil or groundwater concentration contour line equivalent to the cleanup goal, or contour lines representing the presence of mobile nonaqueous phase liquid (NAPL). The target treatment zone should be represented in three dimensions, and the geospatial method and software to be used selected accordingly (for example, perform interpolation of distinct vertical intervals and combine, or use 3D interpolation in sophisticated software such as EVS/MVS or Isatis).
- Select the optimal remedial technology considering geospatial factors such as: depth to groundwater and groundwater flux, stratigraphic elevations, contaminant concentrations, and total mass. These parameters can be interpolated using simple, more complex, or advanced methods to assist remedy selection. For example, technologies such as excavation may not be cost-effective at deep depths, and injection-based remedial technologies may be ineffective in low-permeability strata. Additionally, the mass of contaminant that will be treated in situ or extracted and treated drives decisions on in situ amendment requirements and above-ground treatment infrastructure (such as granular activated carbon versus thermal oxidizer technology).
- Create continuous stratigraphic layers for input into groundwater models such as MODFLOW, and continuous fields of model parameters and boundary conditions such as hydraulic conductivity/transmissivity and recharge. Groundwater flow and contaminant fate and transport models have numerous uses in remedy optimization, such as:
    - determining the minimal number and lowest possible flow rate of extraction wells in a pump and treat system that will successfully capture a contaminant plume
    - quantifying contaminant mass discharge from a contaminant source area and how that discharge changes due to remediation
    - predicting future changes in contaminant concentrations resulting from remediation or long-term MNA
- Calculate mass discharge as the product of concentration and groundwater flow rate. More generally, models can be used to identify data gaps and inform sampling design, together with geospatial analysis. For example, models can evaluate what source strength and geometry may be needed to generate an observed plume. Contaminant fate and transport models can also be used to differentiate between multiple contributing sources to a plume for use in litigation cases or remediation cost-sharing arrangements.
- Evaluate changes in groundwater elevations, contaminant concentration and mass over time to evaluate remedy performance, design modifications to existing remedies, and make decisions regarding remedy completion or transition to a different remedy, such as MNA. Using geospatial methods to create potentiometric surface contour maps is typically required to delineate pump and treat capture zones and the hydraulic effects of in situ injections, such as groundwater mounding, that may significantly alter natural groundwater flow directions. Geospatial interpolations may show a benefit in focusing remedial efforts on areas with persistent impacts. Decisions on remedy completion status can be guided by advanced geospatial methods quantifying the probability of exceeding cleanup goals across the treatment zone through indicator kriging or conditional simulation. This may also include using interpolation as part of risk-based remediation; for example calculating exposure point concentrations which may be upper confidence limits on the mean (such as 95% UCL).
- Evaluate spatial and temporal optimization of groundwater monitoring.

As with other optimization applications, using more complex and advanced methods quantifies interpolation uncertainty, which assists decisions regarding the target treatment zone or when remedial action is complete. This method can also be valuable in land use controls as part of an overall remedial strategy. Defensible geospatial interpolation with uncertainty analysis can help to evaluate whether a plume extends to an off-source property that may or may not need a groundwater use restriction.