CHARACTERIZATION OF IMPOUNDMENTS OF COAL COMBUSTION PRODUCTS USING TOWED WATERBORNE AND GROUND-BASED TIME DOMAIN ELECTROMAGNETICS

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New methods are being developed for more efficient characterization and monitoring of landfills and impoundments containing coal combustion products (CCPs), which are located at or near many coal-fired powerplants. Long-term monitoring is performed at these facilities to determine whether or not there has been a release to groundwater, and the extent and distribution of a plume in the event of a release. Plumes from CCP deposits are characterized by high total dissolved solids (TDS) and can contain minor to trace amounts of inorganic elements such as, but not limited to, boron, lithium, and molybdenum. Here, we provide an assessment of a relatively new geophysical approach for remote, non-invasive imaging of groundwater quality near CCP impoundments. Leachate from CCPs commonly exhibits high electrical conductivity, which provides a basis for geophysical detection and monitoring using electrical or electromagnetic (EM) methods. Recent advances in time-domain EM (TEM) technology now allow for rapid subsurface characterization over large areas using antennas towed behind vehicles (e.g., all-terrain vehicles) on land (tTEM) or towed by boats in floating arrays (FloaTEM). Like other electrical and EM methods, tTEM and FloaTEM provide valuable information about overburden thickness, geologic structures (e.g., faults), lithology, and pore-fluid TDS (or more ionic strength). Depending on data quality and subsurface or water-layer conductivity structure, tTEM and FloaTEM are capable of imaging to depths of 70+ meters. We conducted tTEM and FloaTEM surveys at a CCP site adjacent to a river. Despite the presence of high-voltage power lines, railroad tracks, and other power-generation infrastructure that poses challenges to TEM, overall data quality was high. Images from the field demonstration were derived from laterally constrained two- (2D) and three-dimensional (3D) inversions of ground-based tTEM and waterborne FloaTEM data, respectively. In total, over 20 line-km of data were collected and inverted. The 3D subsurface conductivity structure was interpreted to (1) infer the location of a known fault, and (2) identify anomalies consistent with high TDS, consistent with possible leachate. Although further testing is required to confirm geophysical interpretations, this work demonstrates the value of integrated tTEM and FloaTEM to provide high-resolution information between conventional wells around CCP impoundments.