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Product Abstract

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Groundwater Quality Signatures for Assessing Potential Impacts from Coal Combustion Product Leachate

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Abstract

Boron and sulfate are recognized as potential indicators of the influence of leachate from coal-combustion products (CCPs) on groundwater quality However, there are cases in which these two constituents do not provide sufficient data to characterize groundwater for potential impacts from CCPs. In these cases, the concentrations of other indicator constituents in solution and/or advanced analytical techniques may be used to support other information A three-tiered analysis approach can provide a water-quality signature to help determine whether a groundwater impact is or is not associated with CCP management

Tier 1 uses readily available trend and statistical analysis techniques to evaluate concentrations of reliable indicator constituents for CCP leachate for preliminary site investigations and detection-monitoring programs. Indicator constituents are ideally based on site-specific leachate analysis. For coal ash, they may include one or more of B, Mo, Li, SO_4, Br, K, Na, and F, for FGD gypsum, they may include SO_4, F, Ca, B, Br, and Cl. These constituents are often present in the leachate, and they are relatively mobile and nonreactive in hydrogeologic environments typical of CCP-management facilities.

Tier 2 uses combinations of major ions and CCP indicator constituents to geochemically evaluate water-quality signatures for CCP facilities when a release of leachate to groundwater is suspected but cannot be confirmed or refuted using Tier 1 techniques Piper diagrams, Stiff diagrams, and comparison of ion ratios are key methods in Tier 2 analysis.

Tier 3 uses stable isotopes to evaluate the source of CCP indicator constituents when a release of leachate to groundwater is suspected but cannot be confirmed or refuted using Tier 1 or Tier 2 techniques. Isotopes of boron and strontium have been used in applications at CCP-management facilities. Available data suggest that these constituents tend to be isotopically lighter than background groundwater, although site-specific testing is always necessary. Isotopes for other constituents, such as sulfur and molybdenum, may be applicable to CCPs but have not been extensively applied. An isotope investigation requires measurement of isotope ratios in source water and background water, plus supporting data from Tier 1 and Tier 2 techniques, to maximize potential for meaningful interpretation. It is also important to work closely with experienced, high-quality isotope laboratories to assure that samples are collected and analyzed appropriately

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