BOREHOLE GEOPHYSICAL APPLICATIONS IN WATER SAMPLING FOR ARSENIC STUDIES

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ABSTRACT

Except in the rare situations where sampling wells produce water from a perfectly homogeneous and laterally continuous aquifer, the concentration of constituents such as arsenic in sampled waters represents a mixture drawn from different subsurface units. Sampling wells can be completed over short intervals to insure that samples are derived from precisely defined depths, but additional information is usually needed to identify which zones to sample. Geophysical logging provides a source of such information by placing the potential sampling depths within the context of subsurface structure and ground-water flow paths. We review the logging techniques that can be used to define the hydrostratigraphy of a study site and to determine the hydraulically active zones within sampling boreholes. These methods can be used, for example, to identify the individual fractures or bedding planes that contribute flow to boreholes during sampling, and to assess the relative contribution of each such zone to the composite sample. Logging techniques are used to identify situations where there is ambient cross-flow within subsurface horizons so that packers or well completion can be used to prevent contaminant movement into otherwise uncontaminated receiving zones. We cite specific examples where: 1) conventional sampling fails to indicate the presence of aquifer units that contain elevated dissolved solids or contaminants, and 2) ambient cross-flow in open boreholes has spread contamination from one zone to other, non-contaminated zones. Borehole flow models can also be used predict the response of borehole intervals to water sampling procedures when there are questions about the origin of arsenic or other constituents in analyzed samples.