Making the Transition from Active Remedy to MNA

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Background/Objectives. Many sites use active remedies such as pump-and-treat or in situ remediation to clean up groundwater contamination. Natural attenuation processes, such as natural degradation or hydrodynamic dispersion, also contribute to the cleanup. As remediation progresses, a point is often reached where the time required to reach the remedial objectives using the active remedy is roughly the same as the time required if the active remedy is shut down and the remediation of the site is provided by the natural attenuation processes. From this point forward, the extra effort and expense of the active remedy provides no benefit over natural attenuation, and it may be appropriate to transition the site to monitored natural attenuation (MNA). Unfortunately, there is no well-established approach to determine when it is appropriate to shut down the active remedy. The presentation will propose a simple framework to evaluate a site to determine whether active remedy has brought the site to a condition where the site can be transitioned to MNA. The framework will apply existing tools and approaches to evaluate MNA that can be adapted to evaluate a transition from active remedy to MNA.

Approach. The following approach is appropriate at sites where there is a specified date by which the goal for cleanup must be attained. At sites where the goal must be attained in every well on the site, monitoring data from the period before the remedy was installed is examined to extract a first order rate constant for attenuation over time in each well under natural attenuation conditions. The rate constant for each well, the current concentration in each well, and the goal are used to predict a time when the goal will be attained in each well. Then the predicted time is compared to the time specified for the site to attain the goal. At sites where the goal must be attained in a point-of-compliance well, a computer model is calibrated to conditions at the site before the remedy was installed to extract rate constants for natural degradation of the contaminant. Then the model is calibrated with the rate constants and the current conditions at the site that are produced by the active remedy to predict the concentration at the point-of-compliance well at the specified time that the goal must be attained.

Many sites do not have a specified date by which the goal must be attained. In this situation, data can be evaluated for the time interval where the benefit of the active remedy has approached an asymptote. If there is no statistical evidence that the rate of attenuation over time in the monitoring wells is faster than the rate of attenuation before the remedy was installed, that determination can support a decision to transition to MNA.

Lessons Learned. To make a credible argument that a site is ready to transition to MNA, it is necessary to make a robust forecast of the future behavior of the contamination in groundwater. If the goal is to remediate the entire site, a robust forecast requires well-specific rate constants for attenuation over time in individual monitoring wells. If the goal is to remediate a point-of-compliance well, a robust forecast requires site-specific values for the rate constants for natural degradation in the flowing groundwater. The uncertainty associated with the rate constants must be established to allow a sensitivity analysis of the effect of the uncertainty in the rate constants on the evaluation.