Benefits of Using Down-Well, Real-Time, Telemetric Water Quality Meters to Monitor the Effects of an In Situ Chemical Oxidation Remediation

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Background/Objectives.
The Site in Wichita, Kansas, was historically used as a chemical storage and distribution facility. Previous investigations of the site and adjacent properties revealed that shallow groundwater upgradient as well as soil and shallow groundwater on the Site exceeded the US EPA maximum contaminant levels (MCLs) for drinking water for trichloroethylene (TCE), perchloroethylene (PCE), and vinyl chloride (VC), suggesting on-site and upgradient sources. Remedial efforts have been coordinated through a Kansas Department of Health and Environment (KDHE) case management program. The objective will be to introduce Site remediation efforts completed to-date, present the benefits realized by using the real-time water quality meters, and explore additional applications of this relatively new technology.

Approach/Activities.
In 2007, 683 cubic yards of soil and concrete was excavated and landfilled as part of an interim source removal effort at the Site. In 2016, in situ chemical oxidation (ISCO) was initiated to treat the remaining volatile organic compounds (VOCs) in groundwater using potassium permanganate introduced through injection wells. As part of the 2016 ISCO remediation, real-time In-Situ Inc. Aqua TROLL 600 Multi-parameter sondes were deployed in three monitoring wells shortly before the oxidant injection. Data readings for pH, dissolved oxygen (DO), conductivity, oxidation reduction potential (ORP), temperature, water level, and barometric pressure were collected every 15 minutes and uploaded to the HydroVu website daily. Since injection of oxidant, the benefits of deploying the sensors have been evaluated.

Results/Lessons Learned.
Use of multi-parameter sondes, collecting data at 15-minute intervals rather than quarterly, monthly, or even daily, greatly improved the accuracy of estimating the time for depletion of chemical reactivity and the potential for unrelated interference due to precipitation from rain events.

The groundwater quality was evaluated at four locations over the investigation: MW-2S and MW-3S (down gradient), MW-4S (cross gradient), and MW-7S (inside injection zone). A lack of unexplainable anomalies and consistency in the data suggested that the ISCO process proceeded as planned. ORP and conductivity were expected to rise due to injection of the potassium permanganate in solution, pH to decline, temperature to rise since injection water was slightly warmer than groundwater, DO to rise due to oxygenation of injection water, water levels to rise slightly with addition of a volume of injection fluids.

The magnitude of change and the rate of return of the monitored parameters to pre-injection levels was difficult to predict but simple to measure with the multi-parameter sondes. Using graphical interpretation, the effective duration of the potassium permanganate reaction based on ORP was 50 days. Precipitation did not have any effect on water levels, which remained relatively constant during that time but trended seasonably downward. Quarterly groundwater monitoring data, complimented by further multi-parameter data evaluation using the sondes, confirmed a reduction in VOCs in groundwater and a successful remediation by June 2017.