Successful Treatment of 1,4-Dioxane with In Situ Ozone

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Background/Objectives. 1,4-Dioxane is present in a locally-confined aquifer at an active industrial facility in Puerto Rico. The groundwater flow direction is influenced by off-site production wells and a buried sand-gravel paleochannel. While other co-contaminants are present in groundwater at the site, 1,4-dioxane is the key regulatory driver because of its recalcitrance and mobility in the subsurface. This paper presents the details of remediation technology evaluation, field-scale implementation, and performance results of ozone treatment of this emerging contaminant in a challenging site setting.

Approach/Activities. Technology screening for 1,4-dioxane treatment in this setting has been evaluated with a combination of desktop/literature study and site-specific bench testing. The treatment scenario that was selected was a reactive barrier installed at the leading edge of the 1,4-dioxane plume. The first round of technology screening was documented in a draft Interim Corrective Measures Study (ICMS) submitted in late 2013. At that time, use of in-situ chemical oxidation (ISCO) with ozone had been documented in laboratory and field-scale studies performed by others. Though ongoing research has indicated potential for treatment with aerobic in-situ bioremediation and use of ISCO with persulfate or permanganate, ozone is the technology that was ultimately selected for the low concentration leading edge of the 1,4-dioxane plume.

Results/Lessons Learned. The ozone sparging system was installed in fall of 2016, and began continuous operation in December 2016 after receiving required regulatory approvals. Performance data has been collected on a bi-monthly basis since the system began operating. Based on the data available at the time of this abstract, 1,4-dioxane concentration reductions of up to 85% have been attained. Concentrations of other constituents, including benzene and vinyl chloride, have also been reduced to non-detect concentrations. The half-life of aqueous ozone has increased over time, indicating that some of the natural oxidant demand in the injection zone has been satisfied. Approximately one year of bimonthly performance monitoring data will be available in the final presentation, and will include: 1,4-dioxane concentrations over time relative to the 0.46 ug/L RSL target; changes in ozone half-life and radius of influence over time; and operational lessons learned.