

Evaluation of Multiple Remediation Strategies to Enhance Treatment of 1,4-Dioxane with Combined Oxidant Technologies

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Background/Objectives. A bench test is being conducted to refine a combined oxidant remedy for the treatment of 1,4-dioxane concentrations in groundwater. A low concentration VOC plume extends from the former hazardous waste surface impoundment at a manufacturing facility in South Carolina. The downgradient portion of the plume is being targeted for remediation to prevent off-site migration of the residual dissolved phase contaminant mass. The primary contaminant of concern is 1,1-DCE present at concentrations up to 200 ppb, however 1,4-dioxane is also present within the treatment area at concentrations up to 110 ppb.

A slow release multi-oxidant pilot test was conducted in the treatment area to address the 1,1-DCE concentrations. The slow release oxidant provides a sustained release of both permanganate and persulfate. Reductions in 1,1-DCE concentration between 85% and 100% were observed, however, the slow release oxidant had minimal effect on the 1,4-dioxane concentrations. At the time the pilot test was designed, treatment of 1,4-dioxane was not a remediation objective. Decreases in the site-specific remediation goal for 1,4-dioxane have resulted in new remediation objectives in the treatment area and consequently the pilot test is being redesigned to include bench testing of treatment for 1,4 dioxane.

Approach/Activities. A bench test is being conducted to evaluate potential design changes to the existing slow release multi-oxidant pilot test that will increase the rate of 1,4-dioxane degradation. The following remediation strategies are being evaluated as part of the bench test:

1. A 2D tank study to evaluate whether additional slow release oxidant injection rows would provide sufficient reaction kinetics to oxidize 1,4-dioxane to the site-specific remediation goal of 0.78 ppb;
2. A 2D tank study to evaluate whether priming the aquifer with a pressurized liquid oxidant injection prior to slow release oxidant placement would enhance 1,4-dioxane degradation rates;
3. A batch study to compare 1,4-dioxane degradation rates resulting from a standard high concentration mixed oxidant pressurized liquid injection to the degradation rates achieved with the low concentration slow release mixed oxidant; and
4. A batch study to evaluate the 1,4-dioxane degradation rates of a low volume high concentration liquid injection of combined permanganate/persulfate liquid oxidant injectant.

The initial oxidant mix ratio of permanganate and persulfate will be 1:1. The oxidant ratio will be adjusted to during bench testing based on the data to determine the most efficient oxidant ratio.

Results/Lessons Learned. The bench test began in August 2017 and will be complete by the end of November 2017. The presentation will provide detailed analysis of reductions in 1,4-dioxane concentration achieved by each of the four scenarios being evaluated as part of the bench test. Conceptual designs for the remedies will be provided along with cost estimate comparisons for full scale implementation.