# An Approach to Evaluate Whether There Has Been Sufficient Active Treatment to Justify a Transition to MNA

***John T. Wilson*** (john@scissortailenv.com) and Barbara Wilson (Scissortail Environmental Solutions, LLC, Ada, OK, USA)
Mark L. Ferrey (Minnesota Pollution Control Agency, St. Paul, MN, USA)
David L. Freedman and Olivia Dunn (Clemson University, Clemson, SC, USA)
Dave Adamson and Charles Newell (GSI Environmental, Houston, TX, USA)

**Background/Objectives.** Pump-and-treat remedies are often carried out to prevent a plume of groundwater contamination from reaching a receptor or extending past some regulatory point of compliance. In most cases a remedy is operated in the source area of the plume until the remedy reaches a natural endpoint and provides no further benefit. When the remedy reaches the endpoint in the source area, there are often wells between the source area and the point of compliance where the concentrations of contaminants are above the clean-up goal. What is the risk of leaving this residual contamination in place? GSI Environmental as part of ESTCP project ER20-1429 is developing a decision support tool to answer this specific question. Monitoring data collected before the implementation of the remedy are examined to extract a rate constant for attenuation with distance along the flow path to the point of compliance. When the site is evaluated for transition, the rate constant is used to determine if the residual concentrations of contamination in down gradient wells can be expected to exceed the clean-up goal when the contaminated groundwater reaches the point of compliance.

**Approach/Activities.** The tool was used to make a retrospective evaluation of active treatment of PCE, TCE, and DCE at Site A at the Former Twin Cities Army Ammunition Plant north of St. Paul, Minnesota. The rate constant for natural attenuation of total chlorinated alkenes before the remedy was implemented was 0.0021 per foot. In the down gradient wells, almost all the PCE and TCE has been dechlorinated to *cis*-DCE. A conventional microcosm study provided a rate constant for degradation of *cis*-DCE of 0.73 per year. The average seepage velocity at the site is 210 feet per year. The seepage velocity and the microcosm study predict a rate constant of 0.0035 per foot of travel. The conventional microcosm study could explain and validate the empirical rate constant extracted from the field-scale data. A pump-and-treat remedy was implemented between 1994 and 2008. The site was evaluated in 2015 and was transitioned to MNA. In two of the wells, the concentrations of *cis*-DCE in 2015 were above the clean-up goal and were only slightly lower than concentrations before active treatment. However, the field-scale rate constant for attenuation with distance indicated that the concentrations in these two wells would not exceed the clean-up goal when the groundwater reached the point of compliance.

**Results/Lessons Learned.** The tool provided a simple benchmark that indicated that it was appropriate to transition the site to MNA. Yearly monitoring since 2015 supports the decision. There is no indication that the higher concentrations in the two wells have migrated to downgradient wells. The sediment used to construct the conventional microcosm study was collected in 2005 and described the anaerobic conditions before cleanup. The site transitioned to aerobic conditions by 2016. A new study was conducted on sediment collected in 2019. The rate of degradation of cis-DCE under aerobic conditions is much faster than the degradation in the previous study.