Challenging In Situ Chemical Reduction PRB Approach on Industry Impacted by Chlorinated/Zinc/Copper Bioremediation in Brazil

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Background/Objectives. A steel cord plant for radial tire manufacturing operated since the 1970s. Two distinct plumes of zinc and chlorinated were identified. The zinc plume is associated with past leakage of liquid effluents from the pipeline that transports acid effluents to the WWTP, and the chlorinated plume source probably dates back to the activities of the former wire extrusion plant where organic solvents were widely used. Both plumes are migrating off site. The mathematical modeling indicated that, at the source area, there is no tendency for expressive vertical migration but, in contrast, the migration through the more superficial layers has the potential to reach the river off site in a period of 5 years.

The original main goal of the first step intervention was to prevent vertical and horizontal migration of the contaminant plumes by installing an ISCR PRB to protect the river, while the client could adopt the necessary corrective actions at the plant structure to avoid additional contamination events and plan the full-scale remediation.

However, just after the PRB installation, there was an important leakage at the WWTP (same source of the zinc plume) and the local MWs reported over 3 million ppb of copper.

Approach/Activities. After bench scale and pilot testing, we decided for Provect-IR and Provect-IRM for the chlorinated and zinc plume PRBs, respectively, due to its unique characteristics to stay steady, stimulate the local microbiology and keep an active reactive zone in the field for several years. The PRBs were installed in 2021, using 24 metric tons of Provect-IRM distributed in 20 injection points, between 5 and 16 bgs, for the zinc plume and 7.5 tons of ISCR-IR distributed in 10 injection points, between 8 and 14 bgs for the chlorinated plume.

The new leakage that formed the copper plume occurred in early 2022.

Results/Lessons Learned. In both areas, about one year after the injections, the analytical results indicated zinc and chlorinated concentrations reduced 90%.

With the PRBs already installed and working well, the question was if the original design would be enough to control this new plume also and if the high concentrations of the new copper plume could affect the local bacterial colonies already developed with the Provectus technologies in place. We went back to the bench scale to simulate the reaction using the same proportions but adding the new plume and the results were satisfactory. We decided to not change the original approach in the first moment and move forward with new plume delimitation and full-scale design, while keep groundwater and microbiology monitoring control.