
Nickel Removal from Groundwater

Challenge

An active industrial site in NJ installed a pump and treat system to extract contaminated groundwater impacted by volatile organic compounds (VOCs) and metals resulting from decades of usage and storage of these materials. System startup was conducted by Envirogen in 2018 with extracted groundwater being treated using a physical/chemical process consisting of metals precipitation, filtration, air stripping, and granular activated carbon (GAC) polishing. Treated effluent is discharged to surface water. After several months of pumping from the extraction wells, the composition of extracted groundwater began to change, with concentrations of several heavy metals, especially nickel, increasing drastically above design criteria and to levels that the system was incapable of removing to below permitted concentrations. Specifically, the levels of nickel at the site were averaging between 200 and 250 ppb in the groundwater, and their targeted post treatment level was 50 ppb of nickel. Additionally, the concentration of hardness in the extracted groundwater was much higher than anticipated, causing fouling of most of the process equipment as the pH was adjusted in the metals precipitation process. Due to historical activities at the site, it is also believed that the nickel was bound to organic matter by a chelating agent, making it even more difficult to remove using conventional methods. Envirogen's operations team brought in our engineering staff to help identify a solution for maintaining effective operation of the system, and for removing all contaminants to below permit levels.

Solution

Envirogen ran a small-scale pilot test on a slip stream of the water downstream of the phys/chem process. The pilot system utilized a specialty ion exchange (IX) resin that was specifically selected for its ability to remove metals including nickel. Based on successful demonstration of the IX resin's ability to reduce the nickel concentration to below the 50ppb limit, Envirogen received the order to install a full-scale system.

Results

Envirogen has been operating the full-scale treatment system onsite for 2+ years and has consistently met the discharge limit for nickel. This is despite widely varying levels of other contaminants such as copper and zinc as well as excessive hardness in the water. The team of 3 full time operators, backed by Envirogen's highly experienced engineering team, determined that properly controlling pH was critical to minimizing precipitation of hardness, and for achieving the highest level of nickel removal through the ion exchange units.

Water samples are drawn and tested monthly, and performance is monitored to assure ongoing compliance.

Envirogen will continue to apply their extensive water treatment and groundwater remediation experience at the site to address the ever-changing contaminant mixture to keep the customer in compliance.