Groundwater Restoration and Long-Term Stewardship at a Former Smelter

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Background/Objectives. Restoration is currently underway for a former lead and copper smelter in El Paso, Texas that operated from approximately 1887 until 1999. As a result of the 100+ year history of operation, groundwater across a portion of the site footprint is impacted primarily with arsenic, with the highest concentrations and majority of groundwater flow both focused along former (now buried) arroyos. These features represent the greatest contribution of contaminant mass flux toward off site receptors, and are the key to an integrated strategy for restoration that not only protects human health and the environment but achieves the best outcome for the community of El Paso by driving the site to an endpoint that can be sustained by a minimal level of stewardship.

Approach/Activities. Rather than a prescriptive approach which relied on physical and hydraulic containment through a barrier and perpetual pumping, the goal is to shift from concentration based compliance to a focus on sufficient mitigation of contaminant flux to be protective of receptors. This goal is being achieved through an integrated and incremental process involving source control (segregation of leachable source material), water management (mitigating rapid recharge in the arroyos to keep clean water clean), and in situ groundwater treatment (multiple technologies to sequester and retain arsenic) including zero-valent iron-based permeable reactive barriers.

Results/Lessons Learned. With groundwater seepage velocities ranging between approximately 4 and 10 feet per day, it was determined that a combined strategy involving source control and water management is needed, with infiltration control mitigating rapid recharge and solute transport in the arroyos. The water management strategies, as well as the channelized and contained nature of shallow groundwater flows created by the arroyos, provided an opportunity for use of sequential permeable reactive barriers as a means of removing arsenic from groundwater and reducing contaminant flux toward off-site receptors. Results indicate that the zero-valent iron barriers have been highly effective for removal arsenic from groundwater, in spite of treatment challenges resulting from groundwater alkalinity and dissolved calcium. This presentation will review the pre-design testing and key design elements (aquifer hydraulics, arsenic uptake kinetics, wall thickness, iron demand to provide the desired longevity, PRB hydraulics, backfill specifications, construction challenges and potential changes over time due to geochemical effects) along with the final configuration of the barriers. It will also review the construction of the barriers and present some post-construction performance data.