Injectant Delivery through Combination of Infiltration Galleries and High Vacuum Extraction

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Background/Objectives. Groundwater beneath the former paint room at a facility in Arkansas is impacted with various VOCs associated with former painting operations. The main constituents of concern are naphthalene, total xylenes, and ethylbenzene, present at concentrations up to 102,000 ppb total VOCs. In addition to the dissolved phase concentrations, a sheen indicative of the presence of free product has been observed at the top of the water table in borings throughout the footprint of the former paint room. The first water-bearing zone is encountered at depths less than 2 feet below ground surface. The concrete floor within the former paint room is approximately 6-inches thick, and is underlain by 6 to 12 inches of gravel building foundation. Fluctuations in the water table during precipitation events results in the saturated zone extending up to the bottom of the concrete floor, and on occasion surfacing in and around the building. The residuum within which the uppermost water-bearing zone is present grades from weathered shale to competent shale over the depth interval of approximately 8 to 15 feet below ground surface.

The floor trench associated with former painting operations extends in a U-shape and runs the length of the northern, eastern, and southern walls of the paint room. The bottom of the floor trench is no longer competent, and it is likely releases from the floor drain contributed to the groundwater impacts. Standing water, likely groundwater infiltration, has been observed in the bottom of the floor trench during investigation activities. Implementation of remedies requiring injection of a liquid amendment in the former paint room is challenging due to the shallow groundwater table in this area. Daylighting of injectant was a primary concern during remediation strategy planning. Mounding caused by traditional pressurized injection would raise the water table and result in daylighting into the floor trench within the former paint room.

Approach/Activities. An injection strategy involving gravity feed injection through infiltration galleries coupled with high vacuum extraction to depress the water table prior to injection was developed to overcome the challenges associated with the shallow water table. The existing floor trench was utilized in the design. A series of new infiltration galleries were installed along the western wall and the central portion of the former paint room. The existing floor trench along the northern, eastern, and southern walls of the former paint room was retrofitted to accept injectant. Four high vacuum extraction wells were installed outside the four corners of the former paint room and one additional high vacuum extraction well was installed in the center of the room.

Results/Lessons Learned. During injection events, the high vacuum extraction wells were pumped to decrease the water table in the injection area and to remove the high concentration groundwater present at the top of the water bearing zone. The high vacuum extraction event was able to dewater the water bearing zone completely to a depth of up to 4 feet below ground surface. Following the high vacuum extraction event, amendment was allowed to gravity feed into the infiltration galleries throughout the former paint room source area. No mounding or daylighting was observed during injection. Contaminant concentrations in performance monitoring wells decreased by more than 50% following the high vacuum extraction

event. Influence from the injectant was observed at a horizontal distance of over 23 feet from the injection galleries.