

Bioaugmentation Design for Treatment of Munitions Constituents

Steven Downey (steven.downey@aptim.com), Robert Mayer (robert.mayer@aptim.com), and Zach Parham (Zach.Parham@aptim.com) (Aptim Federal Services, LLC, Knoxville, Tennessee, USA)

Background/Objectives. The former West Virginia Ordnance Works, near Point Pleasant, West Virginia, was used by the US Army to manufacture 2,4,6-trinitrotoluene (TNT) during the early 1940s. Currently the land is managed as part of the McClintic Wildlife Management Area. Residual nitroaromatic contamination is present in some areas of the site, which is listed on the National Priorities List (NPL). Aptim conducted an optimization study from 2013 to 2018, which included an evaluation of the current remedies at the former Red Water Reservoir (RWR) and Yellow Water Reservoir (YWR) Areas and to determine the best remedial action to expedite site restoration.

In parallel with this study, a separate task was to update remedial goals for these areas. The optimization study concluded that based on the updated remedial goals, achieving response complete utilizing only the existing groundwater pump and treat system will take on the order of 30 to 100 years. The study recommended that the existing remedy be augmented to accelerate groundwater restoration. To facilitate design of this treatment system augmentation, additional site characterization was performed using high resolution site characterization (HRSC) techniques.

Approach/Activities. Results from the HRSC investigation were utilized to identify preferential flow paths in the intermediate water-bearing zone at the RWR Area and the YWR Area and update the conceptual site model (CSM). These results also better defined the nature and extent of contamination and eliminated data gaps. Aptim developed an initial design approach which was presented to stakeholders (client, federal regulators, and state regulator) in a Total Project Planning (TPP) meeting to solicit input and gain stakeholder buy-in to the approach. As of the date of this abstract, an internal draft design consisting of direct injection of emulsified vegetable oil (EVO) and zero valent iron (ZVI) has been prepared and submitted to the client. To facilitate deployment via direct injection, micro-ZVI (mZVI) was selected as the ZVI product. The design incorporates grid injection as well as biobarriers to achieve remedial objectives.

The quantity of amendments required to treat each area was determined using site-specific information to calculate the soil mass for each area based on the available mass of soil that is in contact with the groundwater. The enhanced reduction of nitroaromatics (ERN) amendments will be injected into five areas at the RWR Area at depths from 40 to 75 feet bgs and seven areas at the YWR Area at depths from 30 to 60 feet bgs. The design will have been through independent technical review and presented to regulators by the time of presentation at this conference.

Results/Lessons Learned. The updated CSM, the detailed design and associated costs for implementation will be presented as well as potential cost savings by eliminating the existing pump and treat system. The TPP process involving all stakeholders throughout the design development will also be presented. Lessons learned associated with utilization of HRSC data for the design and implementation of the TPP process will be discussed.