In Situ Thermal Treatment with Integrated Vapor Oxidation Technology: Design and Lessons Learned with GTR-O Systems

Xiaosong Chen (xiaosong@georemco.com)(GEO, Orange, CA, USA)
Brian Krumbholz and Carol Winell (GEO, Belfast, ME, USA)

Background/Objectives. In 2017, in situ thermal remediation (ISTR) technology was implemented at one of the largest former chemical manufacturing sites in China. The site was polluted with SVOCs including 2,4-dinitro-toluene, 2,4-dinitro-toluene, o-toluidine, and VOCs including 1,2-dichloroethane and vinyl chloride. The major challenges at this site included: a rapid schedule, the low permeability lithology, the complicated composition and distribution of COCs, and the presence of NAPL at varying depths. The cost and complexity of vapor treatment systems at this site posed a significant hurdle, especially considering the urban population and proximity to sensitive receptors.

Approach/Activities. After screening various off-gas treatment methods and their associated tradeoffs at this particular setting, a new GTR-O (gas thermal remediation –oxidation) system was selected and implemented. The GTR-O system extracted the combustible chemical vapors from treated soil and utilized them as supplemental fuel to heat the thermal remediation wells and oxidize the vaporized COCs simultaneously. Vapors extracted from MPE and SVE wells were directed to a vapor conditioning system to remove aqueous phase moisture from the off-gas. Dehydrated off-gas was then routed to the GTR-O units where the contaminants were thermally oxidized. The author will present the design of the vapor conditioning and oxidation modules of this system.

Results/Lessons Learned. Results of operation revealed the GTR-O installation achieved a mean destructive removal efficiency >98%. Further modification of the installation and the addition of a quencher and activated carbon filtration system realized destructive removal efficiencies >99.9%. The author will expound on the lessons learned in the design and operations phases of the project, including: the heat capacity generated and transferred to soil heating by the GTR-O wells, the mass balance of extracted vs. oxidized contaminants, the results of the ISTR project overall (i.e. soil and groundwater COC mass removal metrics) and suggestions for better managing the thermal oxidation process at future applications.