Improving Decision Making for Vadose Zone Remediation of Volatile Contaminants

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Background/Objectives. Vadose zone volatile contaminants are most commonly remediated using soil vapor extraction (SVE), which is typically an effective technology. However, determining the appropriate operational duration can be problematic. Endpoint decisions are often based on reaching some "asymptotic" removal level. The result is that SVE often continues for longer than necessary to be protective or, in some cases, may be shut down prematurely. The Soil Vapor Extraction Endstate Tool (SVEET) offers an improved method to determine when SVE shut down is appropriate. SVEET is currently being updated and expanded in this Environmental Security Technology Certification Program (ESTCP)-funded project. The update will allow SVEET to be used at most sites for estimating the impact of vadose zone contamination on both groundwater at a point of compliance and on soil gas concentrations near potential vapor intrusion (VI) receptors. SVEET is a user friendly, rapid computational spreadsheet tool with an underlying basis in thousands of simulations of three-dimensional, multi-phase contaminant transport that were conducted using the Subsurface Transport over Multiple Phase (STOMP) code. SVEET can be applied at most sites using readily available site data. The objective is to provide the remediation user-community with a tool that will result in more sustainable remediation though better decision making.

Approach/Activities. The original version of SVEET was limited in the range of site conditions that it could address, and did not provide a basis for assessing vapor intrusion (VI). To expand the range of site conditions, approximately 5000 additional STOMP simulations are being conducted. To incorporate VI, the approach of the Vapor Intrusion Estimation Tool for an Unsaturated-zone Source (VIETUS) software is being integrated into SVEET to provide soil gas contaminant concentrations at sub-slab and sub-basement depths at distance from the source. Field demonstration of the updated SVEET tool is underway at a multitude of DoD sites with two objectives. The first objective is to "ground-truth" the software; that is, to evaluate how well the tool predicts actual site conditions at sites where SVE has not been recently operational. The second objective is to evaluate the tool's applicability and ease of use by DoD staff and contractors. Additional improvements to the tool will be made based on demonstration results.

Results/Lessons Learned. An initial survey of sites found widespread interest in and need for the tool, and identified the parameters in need of expansion. The updated SVEET will allow for residual moisture saturations from 0.05 to 0.75, source thicknesses up to 500 ft, source areas up to an acre, and groundwater velocities up to 3 ft/day. The allowable proximity of the residual source to groundwater is also being expanded, allowing the tool to be applied to sites where the vadose source is quite close to groundwater. Based on our survey of sites, these improvements will make SVEET a useful tool at the majority of sites.