Cyclical SVE for VI Mitigation of High Strength Soil Gas VOCs at Active Military Building, Naval Air Station North Island

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Background/Objectives. Building 379 at Naval Air Station North Island has a footprint of 172,000 square feet and overlies a light non-aqueous phase liquid (LNAPL) plume comprised of jet fuel and Stoddard solvent mixed with trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA). Estimates of NAPL volumes range from tens to hundreds of thousands of gallons. Approximately 40 percent of the NAPL footprint incudes cVOCs. The depth to the top of LNAPL is approximately 23 feet below ground surface, and thickness exceeds 1 foot. Volatilization of cVOCs from the LNAPL has created a significant cVOC vapor plume underneath the building with initial VOC levels > 10,000,000 µg/m^3. A soil vapor extraction (SVE) system has been in operation with a dual screened well since May 2016, with recovery of >14,000 lbs of VOCs (allowing re-located female personnel to return to the building due to decreases in indoor air VOCs to acceptable levels). The extracted vapors are treated by cryogenic condensation (producing liquid VOCs), which may not be cost effective in the longer term. Cyclical SVE is being considered to optimize costs, while still maintaining a safe environment for workers in the building. The cVOC portion of the NAPL has been biodegrading, as evidenced by elevated levels of cis1,2-DCE and CO_2 in soil gas prior to SVE (with the jet fuel/Stoddard solvent serving as an inexhaustible electron donor), but these levels have decreased since startup, likely due to decrease in anaerobicity.

Approach/Activities. The levels of VOCs in soil gas beneath the building floor have decreased by orders of magnitude, but a number of locations at deeper depth still show > 1,000,000 µg/m^3 of TCE. Vacuum responses indicate a vacuum of over 50 pascals at 150 feet from the extraction well. Three additional SVE well screens were installed in 2017 to expand coverage under the building. The SVE system will be shut down for several weeks in late 2017 to connect the new wells to the extraction system. Levels of VOCs will be measured at multiple locations and multiple depths, coupled with continuous monitoring of indoor air to determine how long the SVE system can be off before there is an increase in indoor air concentrations. Fixed gases will also be monitored to evaluate if biodegradation is enhanced during the shutdown.

Results/Lessons Learned. Cyclical SVE operation allows for optimized operation, in that the system could be switched for at least one month before levels in sub-slab soil gas or indoor air start approaching acceptable levels. Increased rates of biodegradation of TCE were also observed, based on increase in cis-1,2-DCE and CO_2 levels in soil gas.