Long-Term Performance Data for Horizontal SVE System to Mitigate Elevated Indoor Air VOCs and High-Strength Sub-Slab VOCs at an 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 >30,000 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. The cVOC portion of the NAPL has been biodegrading, as evidenced by elevated levels of cis-1,2-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 was shut down for several weeks in late 2017 to connect the new wells to the extraction system. Levels of cVOCs were measured at multiple locations and multiple depths, coupled with periodic and continuous monitoring of indoor air. Over 40 sampling events were conducted for indoor air to confirm the efficacy of the SVE system in maintaining acceptable cVOC levels in indoor air.

Results/Lessons Learned. The SVE system has been successful in maintaining acceptable levels of cVOCs in indoor air since 2016. The levels of cVOCs in sub-slab soil gas have also decreased significantly, with a number of locations showing decreases of several orders of magnitude. Increased rates of biodegradation of TCE were also observed, based on increase in cis1,2-DCE and CO_2 levels in soil gas.