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Implications of Continuous Dynamic Monitoring on Vapor Intrusion Mitigation, Naval Air Station North Island

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Background/Objectives. Vapor intrusion (VI) characterization efforts can be challenging due to complexities associated with background indoor air constituents, preferential subsurface migration pathways, and response time and representativeness limitations associated with conventional monitoring methods. For sites experiencing trichloroethylene (TCE) vapor intrusion, the potential for acute risks poses additional challenges, as the need for rapid response to exposure exceedances becomes critical in order to minimize health risks and associated liabilities. Continuous monitoring platforms can be deployed to monitor indoor and subsurface concentrations of key volatile constituents, atmospheric pressure, and pressure differential that can result in advective transport.

Approach/Activities. A system comprised of an electron capture detector (ECD) integrated with telemetry and geographical information systems was deployed at a building at Naval Air Station North Island (NASNI) in Coronado, California. Pressure differentials between the slab and indoor air were also monitored continuously on a separate platform. The building covers an area 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). Volatilization of cVOCs from the LNAPL has created a significant cVOC vapor plume underneath the building as well as in the indoor air of the building [currently being remediated with a horizontal soil vapor extraction (SVE) well at 10 feet bgs, following sealing of over 15,000 feet of cracks/joints in the floor]. Operation of the SVE well resulted in indoor air levels reaching acceptable levels within a month of initiating extraction. A second ECD deployment is planned with the SVE system off, to determine the amount of time it would take for levels of cVOCs in subslab soil gas and indoor to increase to unacceptable levels. This will allow for optimization of operation and significant cost savings, as the SVE system is expected to be required for several years to a few decades.

Results/Lessons Learned. Temporal correlation was observed between TCE vapor mobility and intrusion (as measured by concentrations of TCE in indoor air), barometric pressure, and pressure differential. Two distinct peaks were observed in TCE: one around noon and the other around midnight. This correlation was observed with a predictable daily frequency even for very slight diurnal changes in barometric pressure and associated pressure differentials measured between subsurface and surface regimes, indicating that advective vapor transport and intrusion can occur when pressure differentials are as low as 20 Pa. This suggests that similar natural phenomena may control vapor intrusion dynamics in other regions exhibiting similar pressure, geochemical, hydrogeologic and climatic conditions. Also, the trends in TCE were observed after sealing of the cracks/joints in the floor, which underscored the importance/need for the following SVE. The second deployment of the ECD will provide an indication of how long the SVE system can be turned off before there is a VI risk in indoor air. This will allow for operation on a limited schedule versus 365/24/7.