To AMR or Not to AMR?: That Is the Question

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Background/Objectives. Hexavalent chromium [Cr(VI)] and volatile organic compounds (VOCs) have been detected at elevated concentrations in groundwater (over 100 milligrams per liter) proximal to the Bay in Operable Unit 20 (OU 20) at Naval Air Station North Island (NASNI) in Coronado, California. The VOC plume is ½ miles long, and the Cr(VI) is at the leading edge of the VOC plume. There is likely an additional VOC source area near the leading edge. Enhanced in situ bioremediation (EISB) technology was implemented in 2012 by direct push injection (DPI) of emulsified vegetable oil (EVO) for microbial reduction of Cr(VI) to Cr(III) and to support reductive dechlorination of VOCs in the portions of the plume with Cr(VI) over 5 mg/L and VOCs over 20 mg/L. EVO had been tested (along with other donors) on bench scale prior to field-scale injections. Commercially available microbial cultures were also injected. To prevent re-contamination of the injection area by the upgradient plume, a 700-foot permeable reactive zone (PRZ) biobarrier was installed. This PRZ is referred to as the upgradient PRZ or UGPRZ. This consists of 38 dual-screened injection wells, some of which are located inside a building. During routine monitoring of a different nearby PRZ (downgradient or DGPRZ), methane was observed at elevated levels at a number of locations. A second round of injections is planned in 2018, during which the addition of anti-methanogenic reagent (AMR) will be evaluated by adding it to a sub-set of the 38 wells and comparing selected metrics in wells proximal to the wells that receive AMR and those that do not. The use of AMR is becoming increasingly prevalent, to reduce methane generation during EVO applications. While methane generation is an indicator of anaerobic biodegradation, excessive methane can have deleterious effects, including a decrease in EVO available for reductive dichlorination. The data will be used to optimize replenishment of the DGPRZ (with over well screens) and future planned direct push injections (DPIs).

Approach/Activities. Monitoring wells located near the planned “AMR Injection Wells” and “non-AMR Injection Wells” will be sampled and analyzed for dissolved methane and selected methanotrophs as well as *dehalococcoides* (DHC) and DHC functional genes. After injections are completed, the analyses will be repeated periodically, along with VOCs and Cr(VI). The soil gas in selected monitoring wells and injection wells will also be analyzed for methane using field instruments on a periodic basis. One or more conservative tracers will be added to selected injection wells to confirm which monitoring wells are influenced by the AMR Injection Wells versus non-AMR Injection Wells.

Results/Lessons Learned. It is anticipated that the results will allow for comparison of the performance of EVO and without AMR, primarily in terms of methane production and effect on DHC and methanotrophs. Secondarily, trends in VOC levels and Cr(VI) will be used to evaluate the efficacy of AMR in biodegrading VOCs and Cr(VI). The results will be used to optimize a much larger replenishment effort that is expected to occur in the next few years.