

Australia's First Installation of Horizontal Wells for In Situ Chemical Oxidation (ISCO) and Biosparging – Lessons Learned

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Background/Objectives. For the first time in Australia, 288 meters of horizontal wells were installed underneath an operational resin manufacturing facility in Botany Bay, NSW. The wells were installed to enable chemical oxidants and compressed air to be sequentially injected into the local aquifer to degrade contaminants present in the vadose and saturated zones.

A narrow and fast moving plume mainly comprising toluene, ethylbenzene and xylenes was detected at the site in 1999, originating from three above and below ground sources. The plume was migrating offsite, with the potential of reaching sensitive human and ecological receptors, therefore a containment system comprising of an air sparging/soil vapor extraction (AS/SVE) barrier was installed along the downgradient boundary of the site in 2011 and has been operating successfully since. The next natural step was to treat the contaminant source zones. However, access to those areas was compromised by significant amounts of above and below ground operational infrastructure. To address site access restrictions, a longitudinal horizontal approach was selected as the only effective method to reach and deliver oxidising reagents and compressed air to the whole extent of the contaminant plume, including the target source zones.

Approach/Activities. Groundwater levels within the site range from 4.8 to 5.2 meters below ground level (mbgl) and the plume extends vertically to 8 mbgl. Therefore, the horizontal well screens were installed at around 8 mbgl, longitudinally to the plume movement direction (north-south). Three horizontal wells were installed, with a total combined screen length of 153 metres. The first ISCO event was completed in August 2017 and comprised the injection of 161,000 liters of reagent. The reagent selected was Modified Fenton Reagent (MFR), a combination of stabilized hydrogen peroxide and chelated ferrous sulfate. The authors believe that this is likely the first time that MFR has been injected through horizontal wells. Three injection events are planned for the site, and will be conducted on a quarterly basis. Each injection event will be followed by a two-week latent period and a performance groundwater monitoring event (GME). Results from the GMEs will be used to assess the efficiency of the treatment in reducing the footprint and magnitude of the subject plume. Three sets of monitoring results will be available by February 2018.

Results/Lessons Learned. The typical equipment setup used in ISCO injections had to be modified to account for the larger-scale of this project. A team comprising local and American companies worked together to complete the job safely and ahead of schedule. Two dedicated progressive cavity pumps transferred the reagent solutions (oxidant and catalyst) from 34,000 liter tanks into each one of the three Ø80 mm injection wells. Permanent dedicated pipework and equipment allowed for a safe operation period. Seven data loggers installed inside nearby vertical wells helped to monitor the process, keeping track of any changes in mounding, temperature and water quality parameters. Mounding peaks of 40 cm and temperature changes of up to 17°C were observed as far as 4 meters away from horizontal well alignments.