Minimizing Chemical Daylighting Safety Issues by Use of Stabilized Hydrogen Peroxide

Gary Cronk, Wally Jensky, Greg Gibbs, and Stan Jackson

Platform Presentation

Bench scale and field injection tests performed at two groundwater contaminated UST sites in Southern California were used to evaluate the treatment success of ferrous catalyzed hydrogen peroxide (CHP) versus sodium phytate stabilized hydrogen peroxide (SHP). Our goal was to identify the best method for obtaining good VOC destruction efficiency using peroxide in the field while minimizing safety issues, specifically chemical daylighting, that often occurs during injection of CHP. The CHP reaction is a Fenton's type reaction that generates excess heat (up to 140 degrees F), rapid decomposition of the peroxide, and a rapid increase in subsurface pressure due to buildup of oxygen gas. The phytate reaction does not generate the excess heat and rapid oxygen release which are responsible for the daylighting of chemicals.

Bench Scale Treatability tests using 10% hydrogen peroxide with a ferrous catalyst (CHP) showed excellent contaminant reductions of 99% to 100% for TPH as Gas and all VOCs. The phytate stabilized test also showed excellent reductions, ranging from 96% to 98% for these constituents. A mass balance was performed and showed that the mass of contaminants destroyed by the ferrous catalyst was 19,767 µg, while the mass destruction using the phytate stabilizer was 18,731 µg (only 5% lower).

A residual peroxide evaluation was performed during the Bench Test and the phytate stabilized sample showed a peroxide longevity of 96 hours (4 days) without substantial decomposition (0% peroxide consumed). Meanwhile, the ferrous catalyzed samples showed 72% consumption after 96 hours and 97% consumption after 120 hours. This indicates that substantially more peroxide is available for longer periods of time during field injections using the phytate stabilizer.

During field injections, chemical daylighting using the ferrous catalyst occurred at both UST sites and caused health and safety issues due to potential worker exposure. The use of phytate was found to minimize the occurrence and severity of chemical daylighting, while still providing good to excellent VOC destruction efficiency. The phytate stabilized peroxide attained VOC reductions of 85% to 95% after 6 months in field injection tests performed at the two UST sites.