The In-Situ Chemical Remediation Innovators for Over 17 Years

Geo-Cleanse® INTERNATIONAL, INC.

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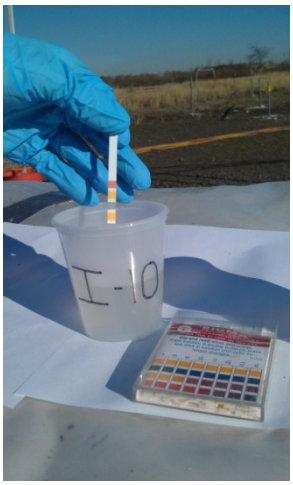
Why pH is Important for the Implementation of a Successful Catalyzed Hydrogen Peroxide ISCO Treatment Program

There are many formulations utilized today to obtain the radicals formed during the catalyzed hydrogen peroxide (CHP) reaction, which are based on the classical Fenton's reagent chemistry. CHP is arguably the most versatile oxidant, and an important question to address during remedial program design is whether acidification is necessary as part of the treatment. Hydroxyl radicals (which are the primary reactants involved in the oxidation of contaminants during a CHP program) can be generated at nearly any pH, however it is important to understand the advantages of an acidic pH catalyst system over a circumneutral catalyst system. Typically, while some contractors mischaracterize acidification to imply a pH of 2-3, Geo-Cleanse prefers implementing CHP under mildly acidic conditions (pH 4-6). This pH range is optimal due to the following primary reasons:



(1) Iron is maintained in the reduced and soluble Fe^{+2} valence state, which is important for reaction initiation. Under circumneutral pH conditions, Fe^{+2} is rapidly oxidized to Fe^{+3}, which reduces the efficiency of hydroxyl radical production and contaminant oxidation.

(2) Dissolved bicarbonate is reduced or eliminated at a pH less than about 6. This is important because bicarbonate is a relatively efficient hydroxyl radical scavenger; under certain conditions hydroxyl radicals may be much more likely to react with bicarbonate than with VOCs.

Iron solubility in the oxidized Fe^{+3} state can be achieved through the use of chelators; however, chelators introduce additional complexities to CHP chemistry. The chelators themselves react with hydrogen peroxide, and thus present an oxidant demand that is

Upcoming Conferences & Events

REDOX TECH, LLC

SE In-Situ Soil & Groundwater Remediation Conference
March 6th-7th, 2012
Raleigh, NC

AEHS Foundation

22nd Annual International Conference on Soil, Water, Energy and Air
March 19th-22nd, 2012
San Diego, CA
Booth # 36

MGP 2012

MGP 2012
March 27th-30th, 2012
Chicago, IL

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commonly far greater than the target VOCs. The use of chelators to implement CHP at circumneutral pH also does not eliminate bicarbonate scavenging of hydroxyl radicals. Bicarbonate scavenging can only be reduced or eliminated under mildly acidic pH conditions. Chelators can also create dissolved metal plumes where they did not exist before, or themselves are often considered contaminants.

CHP Chemistry

$$H_2O_2 + Fe^{+2} \rightarrow OH\cdot + OH^- + Fe^{+3}$$

Hydrogen peroxide reacts very well with naturally occurring iron, and under mildly acidic natural groundwater conditions, little or no iron addition is typically required. Aquifers have a natural buffering capacity, and thus, at sites where pH adjustment is required to achieve the mildly acidic condition, the pH of the aquifer returns to ambient conditions usually within several weeks of injection. The decision to utilize an acidic pH catalyst system or a circumneutral, chelated metal catalyst system requires consideration of site-specific issues. Both catalyst systems have advantages and disadvantages, and there is no "best" catalyst system applicable to all sites. At Geo-Cleanse, our goal is to provide the most effective treatment, and will always optimize the catalyst to best fit the site-specific conditions and treatment objectives.

If you would like to discuss this topic further, please feel free to contact our office.