Chelators Use in Bioremediation Could Replace Oxygen Injection

by John Leonard

Field testing started two weeks ago near Charleston, S.C., on an experimental new ground water cleanup process that may increase the rate of biodegradation of contaminants that result from the breakdown of petroleum, according to federal researchers. Scientists tout the process, anoxic oxidation, as a cheaper alternative to the current method, in which oxygen is injected at waste sites to achieve the same result. At least one expert, however, is skeptical about the potential for reducing costs.

Instead of oxygen, the procedure uses substances called chelators to make ferric oxide more readily available to anaerobic soil microbes. The microbes use it to break down aromatic hydrocarbons in sediments where the presence of these pollutants has produced an anaerobic environment. These microorganisms presently take far longer than aerobic microbes to break aromatic hydrocarbons down into harmless substances.

In the presence of aromatics, microbes consume all available oxygen. The next most abundant source of energy for respiration in water ta bles is ferric oxide. But anaerobic bacteria have greater difficulty producing energy from ferric oxides than aerobic bacteria do from oxygen. In laboratory situations, chelators alleviate this.

Laboratory testing indicates that assisting bacteria in using ferric oxides for respiration may dramatically increase the rate of degradation of several of the more persistent aromatics, including toluene, xylene and benzene. Investigators say the rate of degradation compares favorably to that found in aerobic waste sites.

Derek Lovley, a hydrologist with the U.S. Geological Survey's Water Resources Division in Reston, Va., explained that anaerobic bacteria "use iron the way we use oxygen." Using aerobic bacteria has two technical limitations that the new technology overcomes, Lovley explained. First, oxygen does not dissolve easily in water, which adds to the technical difficulty of this procedure.

Second, targeting aerobic bacteria requires large amounts of oxygen, since this gas is quickly consumed by other organisms in the soil. In the July 14 issue of the scientific journal ***Nature,*** Lovley and fellow researchers write that anoxic oxidation "provides a potential alternative to oxygen addition for the bioremediation of petroleum-contaminated aquifers."

But John Cusack of the World Environmental Center in New York, warned this procedure may be just as expensive as the process it is intended to replace. '"There are a lot of problems associated with some of these new technologies," he told *HWN*. "They work well in the labs, but they tend to get kind of expensive in the field. My suspicion is that they haven't looked at the economics of this."

Dr. Kerry Sublette, a professor at the University of Tulsa's School of Chemical Engineering, expressed cautious optimism for the potential of anoxic oxidation. He said researchers' claims for its ability to break down xylene and toluene are credible. "But I wouldn't believe it for benzene," he added. He said the general hypothesis seems reasonable, but he cautioned that the science of bioremediation is still in its infancy. "The proof will be in the field testing."