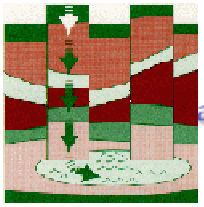

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# Significant Improvement of In-Situ Gas Mass Transfer Performance for Groundwater Remediation Projects

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Enhanced bioremediation for petroleum hydrocarbons or chlorinated solvents or abiotic immobilization of metals has developed into a standard approach for groundwater remediation. One way to accomplish these tasks is using the passive mass transfer of gases into an aquifer. Significant optimization of existing gas diffusion remediation systems which rely on the mass transfer delivery of dissolved gases fall into several areas, including refined system design and layout, system maintenance, well redevelopment, nutrient additions, and where applicable, the use of active mass transfer tools in combination with the passive system.

Site specific improvements in treatment well dissolved oxygen concentration and distribution of dissolved oxygen associated with design improvements and maintenance were documented after changes in treatment well design and the use of aggressive well development techniques.

Improvements in well design\can increase 20 mg/L of dissolved oxygen (DO) as an example, in diffusion wells. Aggressive well redevelopment within the diffusion wells were noted to increase DO levels by an order of magnitude in both diffusion and nearby monitoring wells in a northern California site.

Optimization also focused on development of conditions necessary for increased biomass beyond the supply of oxygen as an electron acceptor including providing sufficient nutrients and biosurfactants where necessary. A better understanding of the treatment zone concept, site hydrogeologic conditions and placement of monitoring wells also improved system performance. Availability of macro-nutrients in the ratio of carbon : nitrogen : phosphorous, at a 100:10:2 level significantly improves hydrocarbon degradation rates. Case examples will be discussed to illustrate optimization.

In a site in Oahu, Hawaii, bioaugmentation, nutrient supplement and electron acceptor solution was applied through an area operating with passive diffusers. The hydrocarbon attenuation efficiency increased in the diffusion wells compared to treated wells without diffusers and the diffuser area wells without the bacterial treatment. The combined use of an active mass transfer tool to reduce initial oxygen demand will also be discussed.