BIOREMEDIATION OF LARGE CONCENTRATION OF ORGANIC COMPOUNDS IN LAGOON GROUNDWATER

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An old landfill close to the Venice lagoon was filled with industrial wastes and it produced a groundwater contamination plume with hydrocarbons and chlorinated compounds. Emergency P&T system was realised in the sandy aquifer (hydraulic conductivity about 10-5 m/s). Nevertheless, the low efficiency, the high costs and the long time needed for the cleanup with the P&T system suggested to consider a bioremediation system to improve the in situ remediation. More complications arise because the area is set below the sea level and land reclamation drainage pumps let the saltwater intrude.
Microbiological and chemical laboratory tests confirmed the feasibility of the bioremediation system. A field test with two different barriers was designed and realized: an anaerobic barrier close to the landfill to start the reductive dehalogenation of the chlorinated compounds and an aerobic one to treat their by-product and hydrocarbons.
In some anaerobic barrier's wells an organic substance able to increase the reductive dehalogenation of chlorinated compounds was injected. In the aerobic barrier an air sparging system was activated and nutrients were injected to treat hydrocarbons and to promote co-metabolism reactions for chlorinated compounds. In both the barriers the mixing of the re-circulated water with the dissolved substances was planned.
In situ chemical-physical parameters and laboratory chemical analyses upgradient and downgradient of each barrier have been executed to check the efficiency of each barrier for a test period of 16 months.
Pumping test and field test data were used to calibrate the withdrawal rate of the wells of the entire barriers and to realise a groundwater flow model in order to evaluate the effects of the enlargement of the field tests barriers.
The efficiency of each barrier was evaluated to be over 90% (concentration reduction) in the monitored period and the model did not show any problem to the enlargement of the barriers up to 400 m length. The positive results of the field tests and of the numerical model lead to enlarge the barriers to the entire side of the landfill.