An innovative Biocirculation® - System for chlorinated aliphatic hydrocarbons (CAHs) degradation with Groundwater Circulation Well (IEG-GCW®)

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Introduction







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Coupling of recirculating well technology (IEG-GCW) with MIWs



A novel approach to improve the distribution of an organic carbon additive (IEG-C-MIX) and stimulate BRD by combining multilevel peripheral injection wells (IEG-MIW) and IEG-GCW®-induced recirculation

Reverse Flow





Standard Flow



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MULTI CRITERIA DECISION ANALYSIS TOOL

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Geological Model Reconstruction



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Contamination status of groundwater





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Multi-scale approach in geological model reconstruction (3D and 2D)



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Contamination status of groundwater

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Remediation configuration





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Stratigraphy



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Evolution of CAH concentrations



0 4 8 11 18 48 53 98 112 124 160 200 252 327 432 527 930 1028 1116 1212 1368 1459 days

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160 200 252 327 432 527 930 1028 1116 1212 1368 1459 days





Compound Specific Isotope Analysis (CSIA) 13C/12C

MLSW 1 (located near the GCW) shows 13C isotope enrichment for VC and cis-1,2-DCE induced by recirculation alone. This trend is amplified after the addition of biostimulants through peripheral injection wells starting at day 240

This process also becomes visible in MLWS 2 with some delay (distance from the well and biostimulant redistribution). The overall reduction of contaminants in groundwater can be related to microbiological degradation processes.



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0 98 124 160 200 252 327 432 527 930 1028 1116 1212 1368 1457 days



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Conclusions

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	journal homepage: www.cell.com/heliyon	diatros

Research article

Remediation of chlorinated aliphatic hydrocarbons (CAHs) contaminated site coupling groundwater recirculation well (IEG-GCW[®]) with a peripheral injection of soluble nutrient supplement (IEG-C-MIX) via multilevel-injection wells (IEG-MIW)

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The multi-source model drives the location, configuration, and deployment of an innovative remediation strategy that is adapted to site-specific physicochemical conditions (Remediation Geology)

IEG-GCW acts as a 3D distributor of nutrients in the aquifer, mobilizes CAHs and stimulates BRD

Hydrochemical and CSIA monitoring reveal in situ biodegradative transformations

The coupling of C-MIX and the GCW system showed rapid abatement of CAHs concentrations at different sampling depths

The strategy generates a long-term persistent hydro-geo-bio-chemical reactor















... all models are approximations. Essentially, **all models are wrong, but some are useful**. However, the approximate nature of the model must always be borne in mind.... **George Box (1976)**

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THANK YOU FOR YOUR ATTENTION!!

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Questions?

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