In-situ application of elemental nanoiron into the subsurface polluted with chlorinated ethylenes

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Contaminated area location

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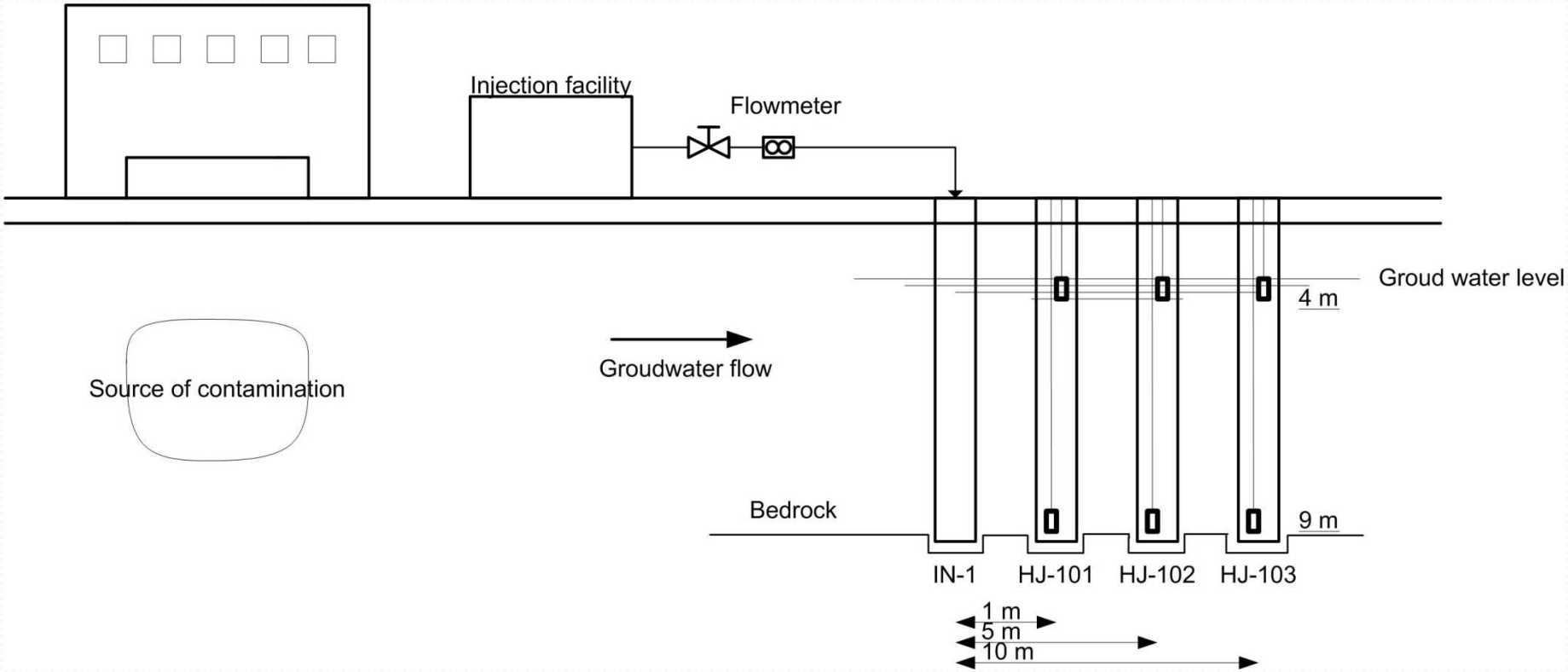
Groundwater quality within the contaminated area

- Disclosure of contamination in 2001
- Main contaminant dichlorethylene (DCE)

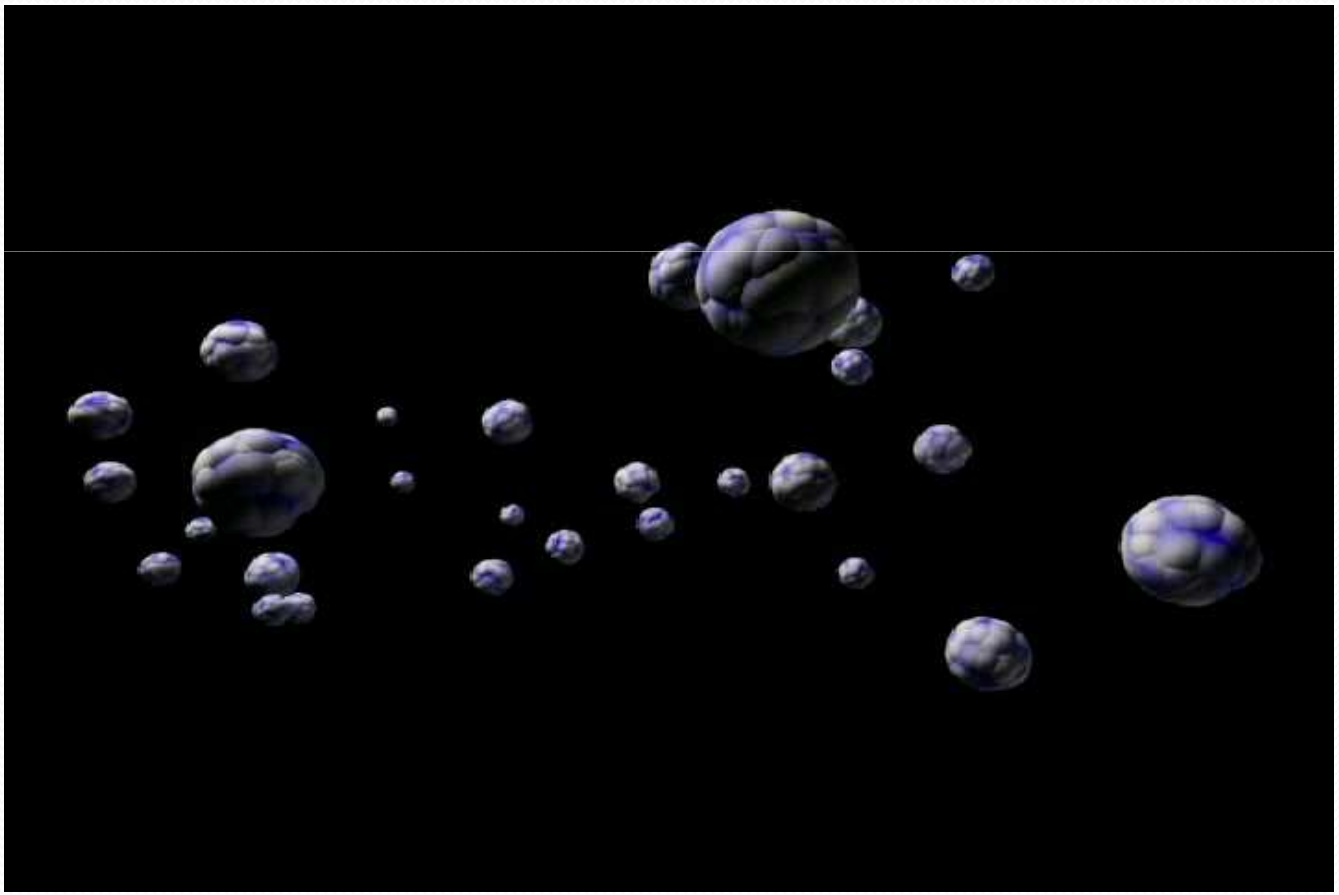
Test area description



nZVI particles of Toda Kogyo Corp. RNIP-10APS

- Physical properties
  - Diametr ~ 70 nm
  - Surface ~ 30 m^2/g
- Chemical properties
  - 5 -17 % Fe^0
  - 1 – 12% Fe_3O_4
  - 75 – 85% water
- Stabilization by polycarboxylic acid

- Particles tend to agglomerate in aqueous media
- Deagglomeration and stabilization to some extent is possible



Test design

- 2 application of nanoiron

First application – 15.9.09

- application of (RNIP 10-APS) nanoiron followed by three weeks periodical sampling of the monitoring wells,
- 2.5 kg of nanoiron
- Injection volume 750 L
- Average injection rate 0.89 $L.s^{-1}$

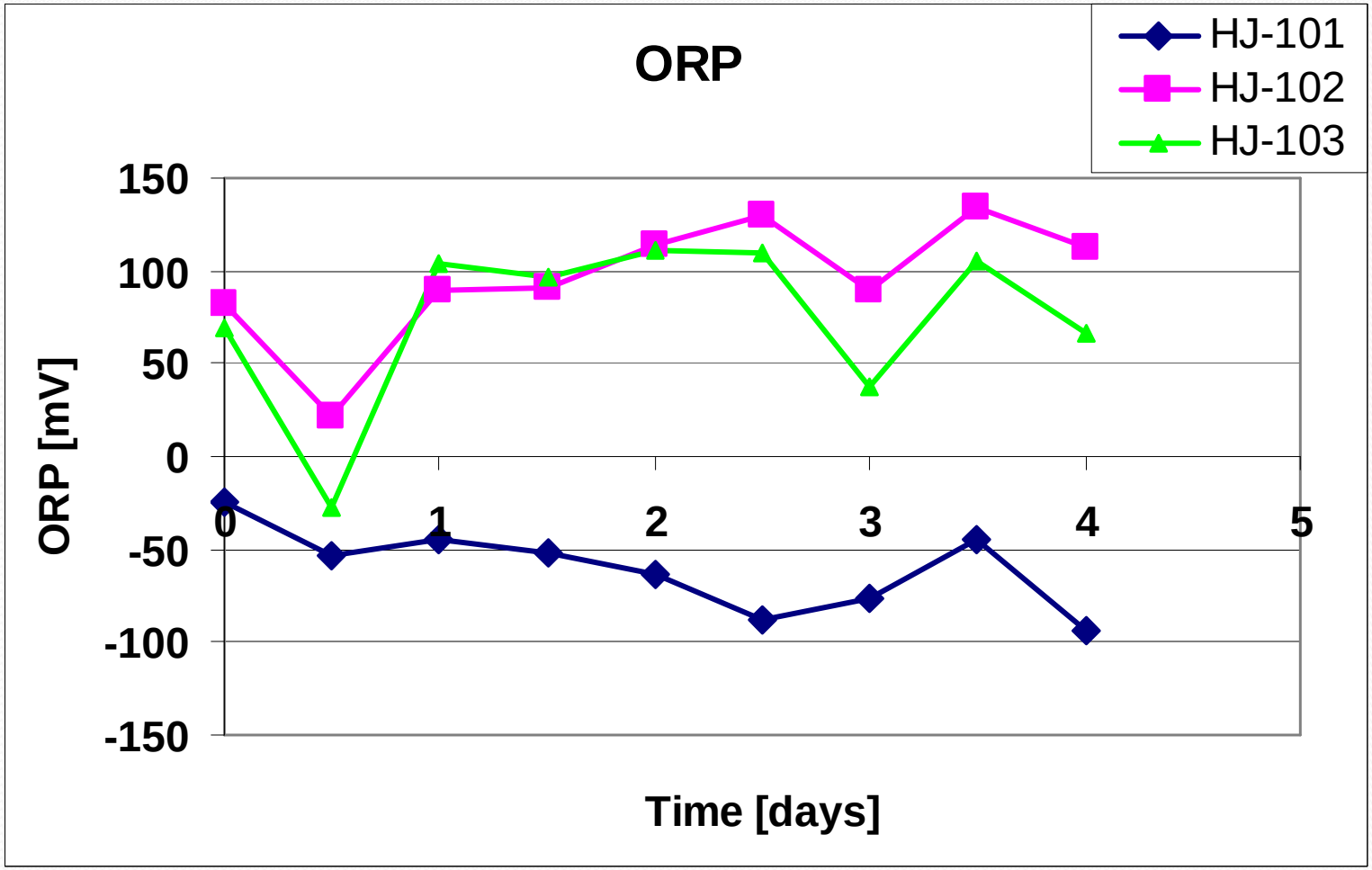
Test design

Second application– 14.10.09

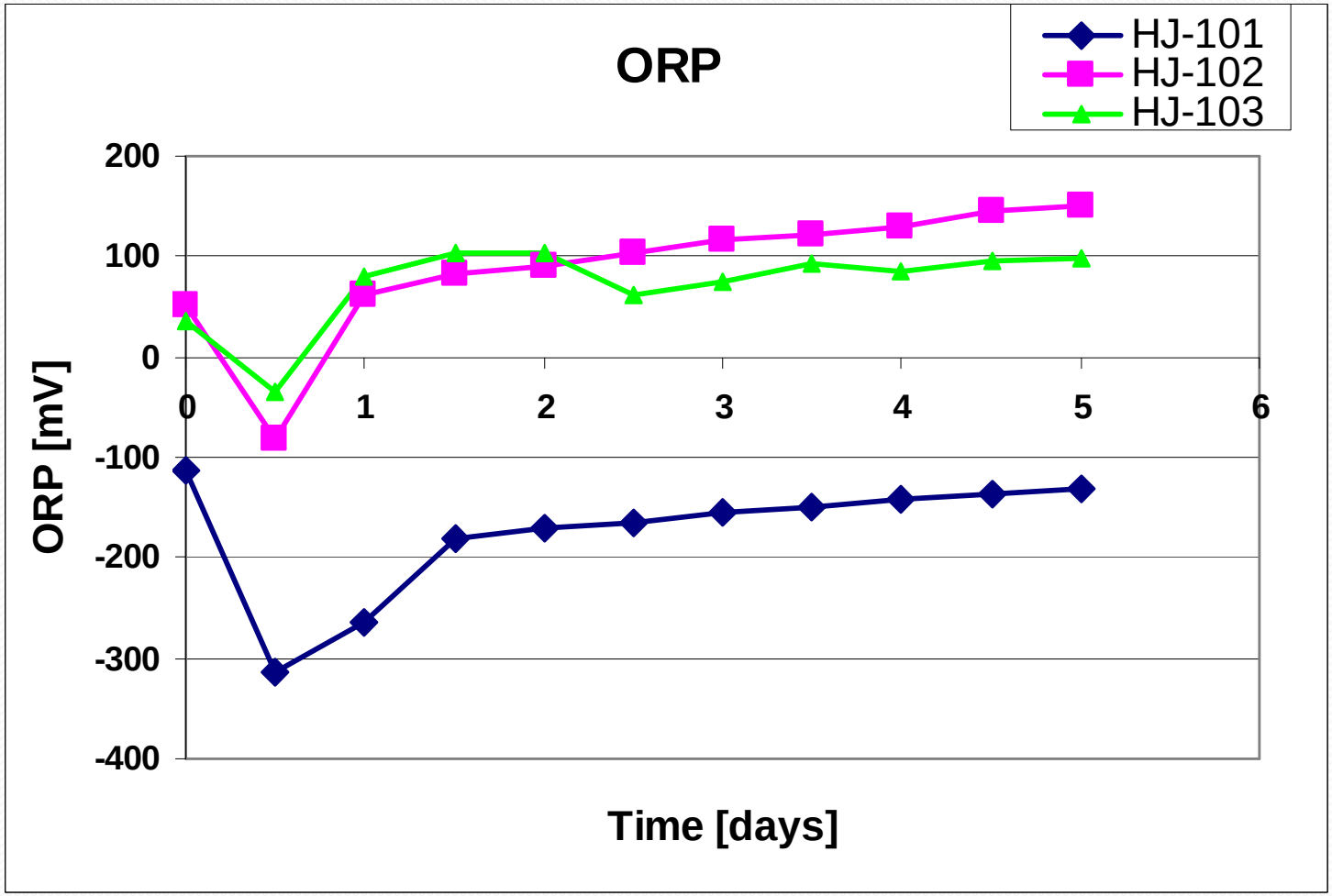
- application of (RNIP 10-APS) nanoiron with modified surface followed by three weeks periodical sampling of the monitoring wells
- 10 kg of nanoiron
- Injection volume 1500 L
- Average injection rate 0.89 $L.s^{-1}$

Injection facility

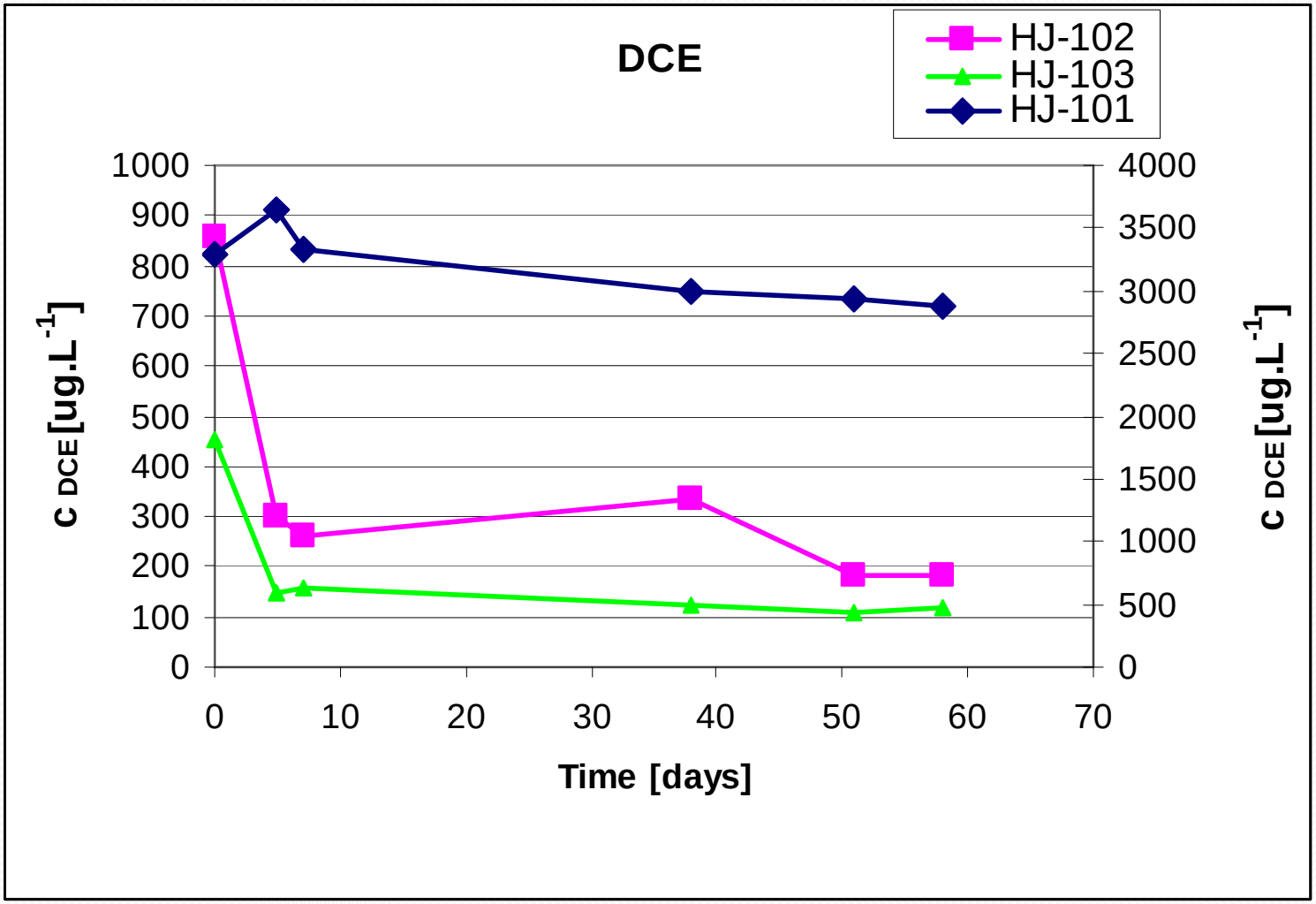
Results of injection 15.9.09 – changes in ORP



Results of injection 14.10.09 – changes in ORP



DCE reduction



Conclusions

- RNIP-10APS product showed sufficient efficiency in chlorinated hydrocarbons degradation
- to achieve more significant pollutant removal higher nanoiron concentration would be needed
- stabilized nanoiron showed high ability to migrate through the soil

Thank you for your attention!