

DIHYDROGEN (H₂) PULSES FOR POSSIBLE APPLICATION IN GROUNDWATER BIOREMEDIATION FROM CHLOROETHENES

C. Valli¹, L. Ferrari², L. Moretti³, M. Agosta³, G. Carnevale², M. Peroni⁴, E. Pasinetti⁴, A. Melzi¹, L. Cavalca^{1*}

¹ Department of Food Science, Nutrition and Environment (DeFENS), University of Milan, Italy - *lucia.cavalca@unimi.it

² TAUW Italy S.r.l., Milan, Italy

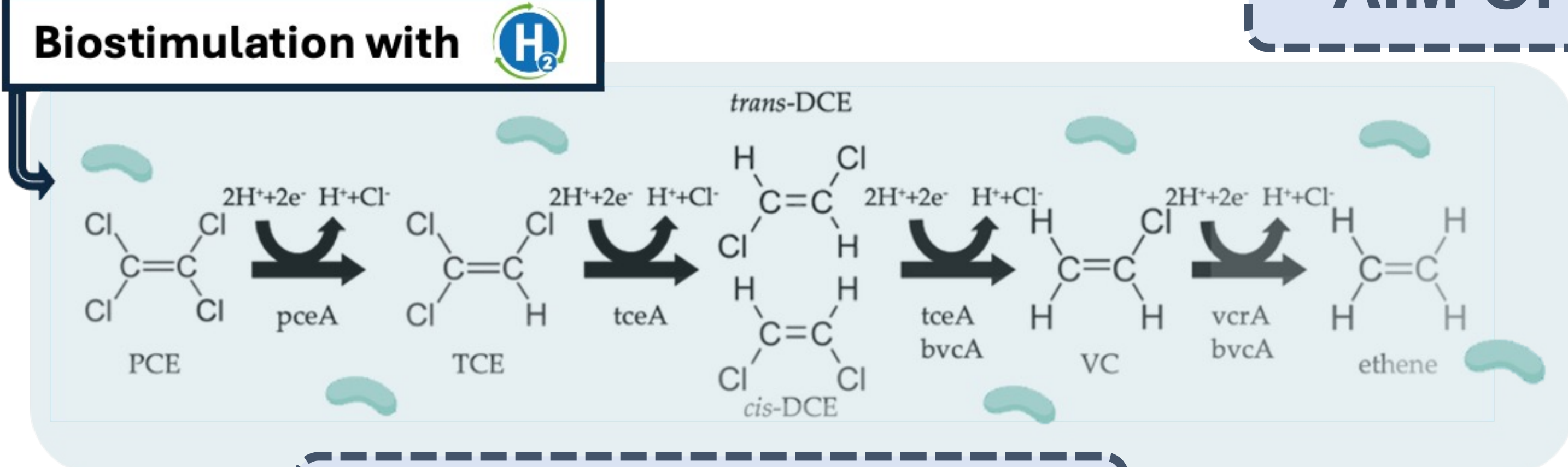
³ Edison S.p.A., Milan, Italy

⁴ SIAD S.p.A., Laboratory of Environmental Biology and Chemistry, Bergamo, Italy

INTRODUCTION

Chlorinated ethenes are groundwater contaminants and a serious environmental issue, posing significant threats to ecosystems and human health. Chlorinated solvents can undergo reductive dehalogenation by organohalide respiration (OHR) of anaerobic bacteria such as *Dehalococcoides* and *Dehalogenimonas*. These processes represent the primary pathway for the degradation of chloroethenes, being the amount of electron donors the principal limitation of the biodegradation process.

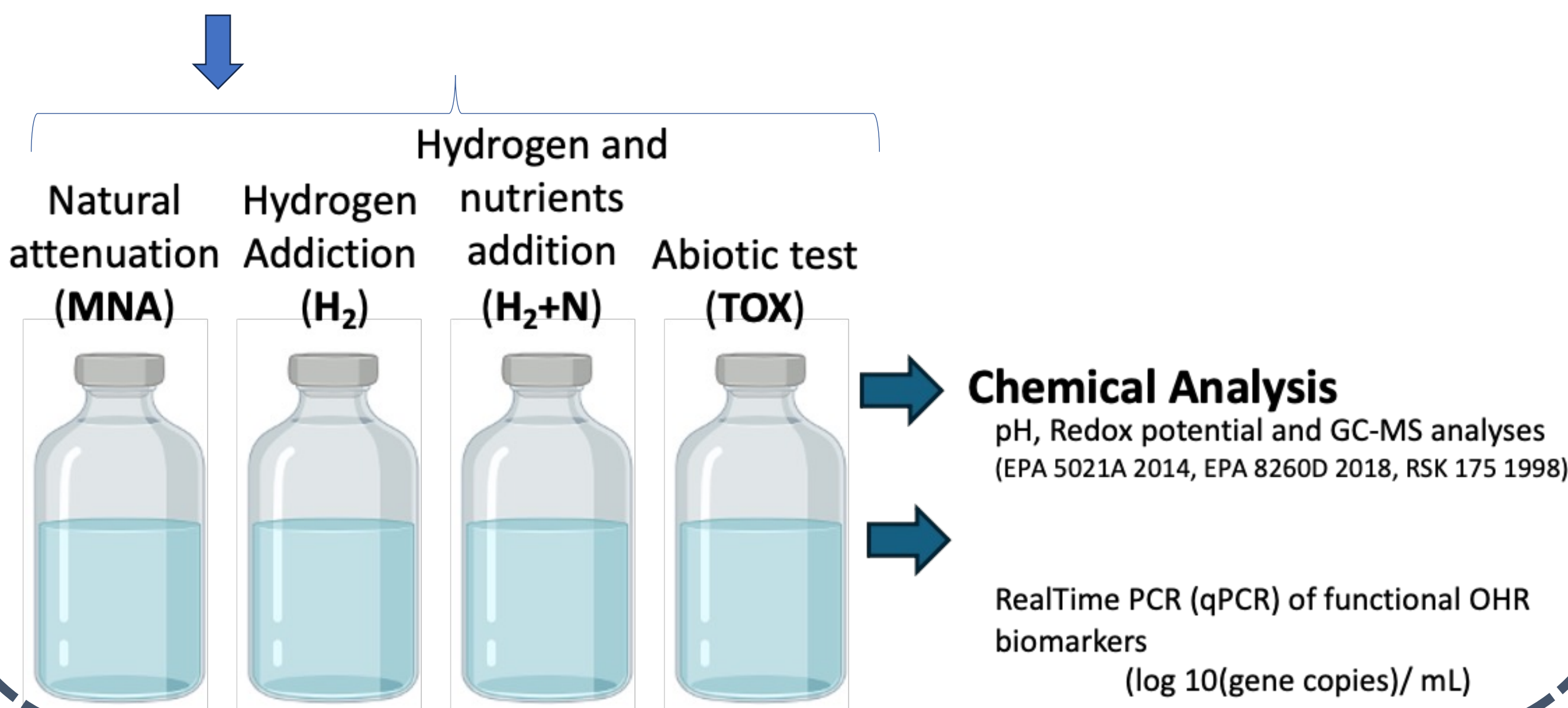
AIM OF THE STUDY



The aim is to investigate the effect of gaseous H₂ pulses on OHR in CE-contaminated groundwater from an Italian aquifer where VCM (150-300 mg/L) represents the major threat.

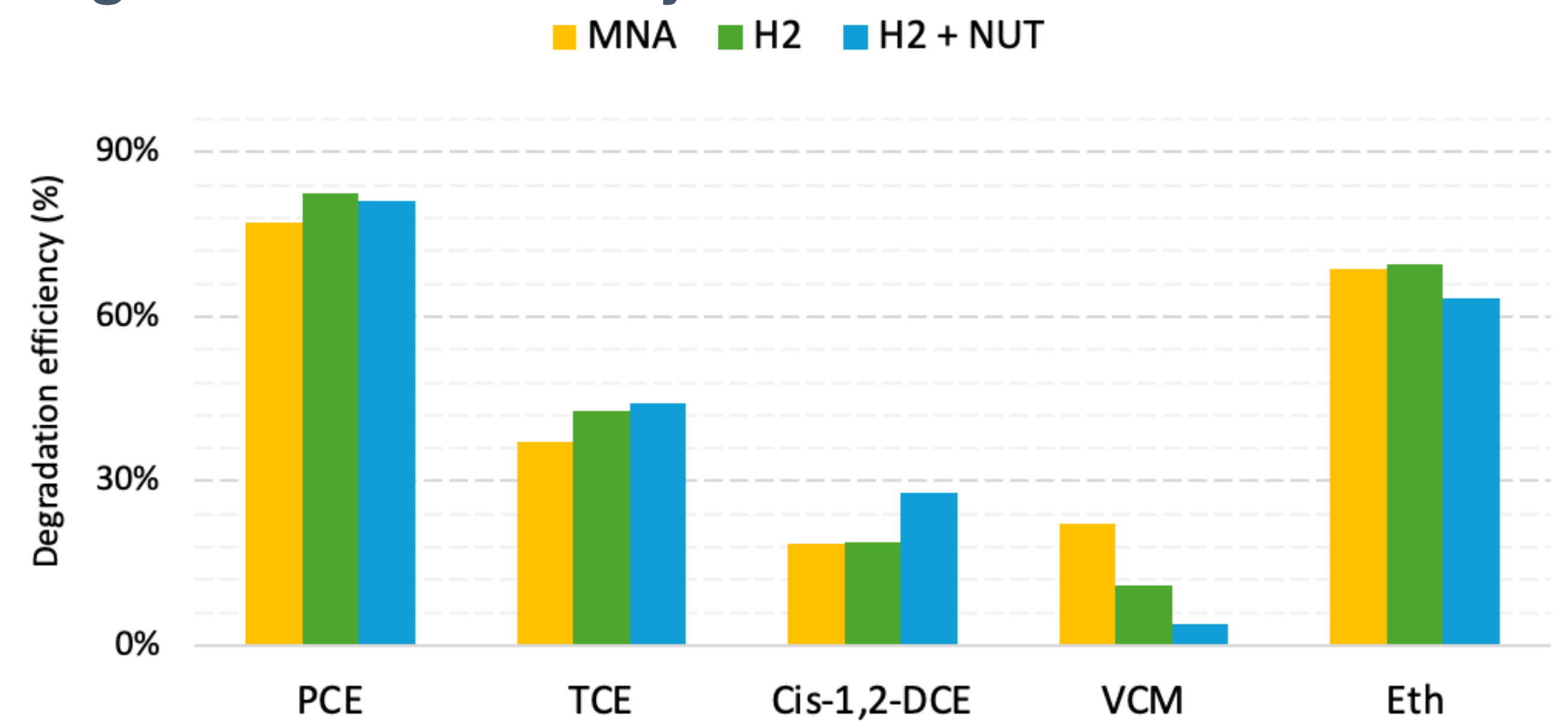
METHODS

- Microcosms were set up in a glove box under continuous gas flow (30:70, CO₂:N₂).
- 4 thesis were analysed after 1, 2 and 6 months



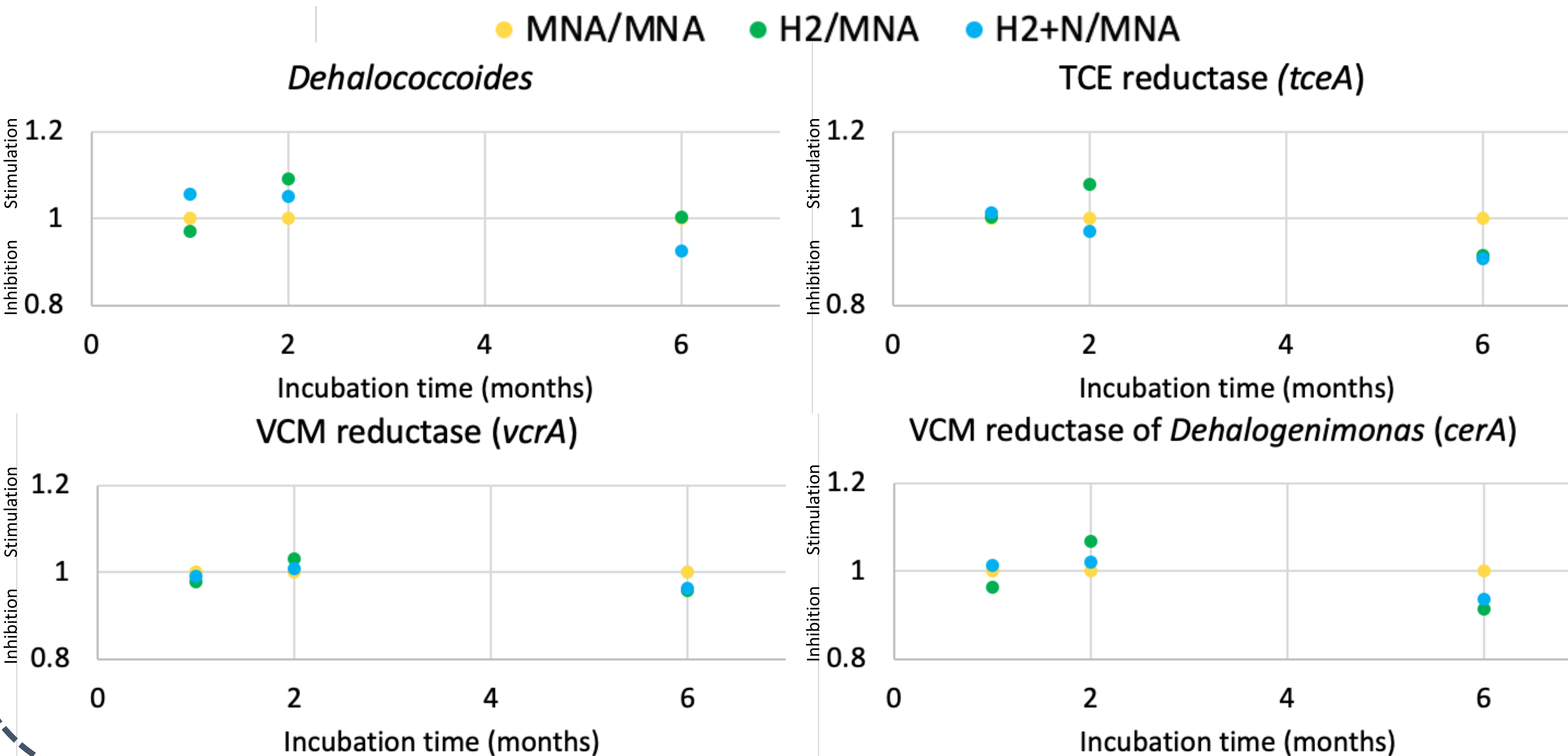
RESULTS

Degradation efficiency after 6-months incubation



- H₂ pulses and nutrient's addition increased the efficiency of PCE, TCE and DCE dechlorination
- VCM degradation efficiency resulted to be negatively affected by the treatments, probably because the higher production of VCM caused its accumulation.

OHR biomarkers: effect of treatments in comparison to natural attenuation



- During the first 2 months of incubation, H₂ pulses stimulated the presence of *Dehalococcoides* and of functional genes for reductive dehalogenation *tceA*, *vcrA* and *cerA*.

CONCLUSIONS

- The studied aquifer hosts natural OHR processes mediated by indigenous *Dehalococcoides* and *Dehalogenimonas* bacterial genera.
- H₂ pulses enhanced OHR of highly chlorinated solvents, although the effect on VCM needs to be clarified.
- Future research at a relevant scale may provide further evidence to support these trends.