



EiCLaR at AquaConSoil 2023

The [EiCLaR project](#) was very active at the AquaConSoil conference held between 11-15 September 2023 in Prague. As well delivering individual research presentations on technical progress throughout the week, a special session was held on 14 September which was solely focused on EiCLaR and it is this session that is the focus of this article.

The special session presented two sustainability assessment case studies of enhanced bioremediation across Europe and was chaired by Nicola Harries, CL:AIRE.

Paul Bardos, r3 environmental technology ltd gave an introduction to the EiCLaR project and an overview of the four technologies being developed: Electro-nanobioremediation (ENB), Monitored Bioaugmentation (MBR), Bioelectrochemical Remediation (BER) and Enhanced Phytoremediation (EPR).

He explained the rationale for the sustainability assessment case studies; their purpose being to compare EiCLaR technologies with pre-existing alternatives on real sites.

The basis for comparison was qualitative and split into three parts: technical, cost effectiveness and sustainability. The assessments all followed a common protocol and were compliant with ISO 18504:2017.



Steffen Hertle, TZW: DVGW-Technologiezentrum Wasser explained how MBR was being modified to enhance the degradation of chlorinated solvents and **Petr Kvapil, Photon Water Technology** described the ENB process and how nanoscale zero-valent iron was being combined with electrokinetic inputs to improve efficiency.



Two sustainability assessment case studies were presented during the session:

Marta Popova and Samuel Wildemeersch, SPAQUE introduced the Nouveaux Ateliers Mécaniques (or NAM) site in the Walloon Region, Belgium. It was a former mechanical factory active between 1907 to 2002. The former factory part of the site is to be developed but concentrations of chlorinated solvents are too high. Hence additional remediation works is required and a qualitative comparison of three EiCLaR remediation technologies (ENB, MBR with in situ flushing, MBR with direct push injection) with a well-established remediation alternative (biostimulation for dehalorespiration) took place.

The comparison ranked MBR with direct push injection high for sustainability and cost and second on technical performance. It was therefore selected as the most appropriate technology.

Overall, the feedback on the assessment process was very positive. SPAQUE held meetings and discussions with the technology developers and found the qualitative assessment easy to undertake and it facilitated the decision-making process for selecting a technology to be deployed on site.



Horst Herzog and Christine Ziegler, Infraserve described the Höchst Industrial Site in Frankfurt, Germany. In 1863 the site was used for dye manufacturing and 160 years of industrial use has resulted in a large, complex site where now 90 companies operate. The site has also been heavily investigated (with over 9000 drillings) and there is an excellent understanding of the contamination beneath the surface.

For the purpose of the case study, the focus was on remediation of chlorinated solvent contamination in the southern area of the site using four technologies - complete dehalorespiration with direct push application of hydrogen release compound (CD), sequential anaerobic / aerobic with direct push application of peroxide for aerobic (SEQ-DP), sequential anaerobic / aerobic with existing monitoring wells used for GW oxygenation (SEQ-GW) and no additional intervention (NAI).

The comparison of options ranked SEQ-GW highest on technical performance, particularly in relation to risk management and time, which were considered most important to Infraserve. SEQ-DP ranked more favourably over sustainability and cost, however, SEQ-GW was considered the overall best option from the assessment.

The feedback on the assessment process was that it was easy to understand and implement and led to guided discussions to consider and rank the reported aspects efficiently.



A general discussion ended the session and two interesting questions were raised by the audience:

How is it possible to rank the social parts within the sustainability assessment (e.g. human health & safety vs neighbourhoods and locality)?

It was explained that these are the headline categories and underneath these sit a number of criteria which provide greater detail and clarity (e.g. given in the SuRF-UK guidance). It was noted that from experience the social part is often the most difficult to work through but if undertaken properly it does add to the transparency of the decision making process.

How are the three aspects of technical performance, cost drivers and sustainability ranked in the overall decision making process?

It was explained that they are not quantitative and it is not valid to use them to choose an overall winner, but the process of going through the comparison is the key part as it provides the basis for a robust discussion and gives the “why” to the final decision.

