

Experience with testing Innovative Remediation techniques at a Danish Megasite Contaminated with a Complex Mixture of Pharmaceuticals

Torben H. Jørgensen (tbj@ramboll.dk) and Lars Bennedsen (Rambøll, Denmark)
Jørgen Fjeldsø Christensen and Mette Christophersen (Region of Southern Denmark, Denmark)
Neal Durant and Leah MacKinnon (Geosyntec Consultants, Columbia, Maryland, USA)
Jeff Roberts (SiREM, Guelph, Ontario, Canada)
Prasad Kakarla (ISOTEC, USA)
Jarl Dall-Jepsen and Lars Nissen (COWI, Denmark)
Preben Bruun, Danish EPA

Background. Kærgård Plantage is the largest and most complex contaminated site in Denmark. From 1956 to 1973, a pharmaceutical manufacturing facility discharged 280,000 m³ of wastewater containing various salts, antibiotics, barbiturates, lithium, mercury, cyanides, aniline and organic solvents (PCE, DCM, benzene, toluene, alcohols) to six pits.

The complexity and variety of contaminants limited the range of viable treatment options.

For source area remediation, excavation, in situ chemical oxidation with Fenton's reagent (MFR) and activated sodium persulfate (ASP), anaerobic bioremediation (ERD), and steam stripping have been identified as potentially effective remedies. Excavation of the source area in two of the six waste pits was completed in 2008. Treatability tests for the above methods has been performed during 2005-2009.

Pilot test activities. Three pilot tests were initiated in June 2010: Pilot Test 1 - ISCO using MFR in an area impacted with a complex mixture of sulfonamides, barbiturates, and; Pilot Test 2 - ISCO using MFR followed by ERD; and Pilot Test 3 - ERD in an area impacted with low amounts of DNAPL.

Studies have shown that excavation only is cost effective in the unsaturated zone. In the saturated zone the most cost effective techniques will be in situ methods, probably a combination of various techniques.

Most of the methods has previous been applied in Denmark, but it is the first time we have combined chemical oxidation and biological treatment.

The pilot test will be completed in spring 2011. Recommendations will be given to point out the most cost effective techniques (or combination of techniques) to remediate the highly complex contamination in the source zone.

At the conference we will present experiences regarding selecting remediation techniques and technology development from our international collaborators. The presentation will focus on comparing traditional methods (excavation, pump and treat) and in situ methods.