



Reference sheet
Pilot test,
injection ZVI

Time of assignment

2019-2020

Client

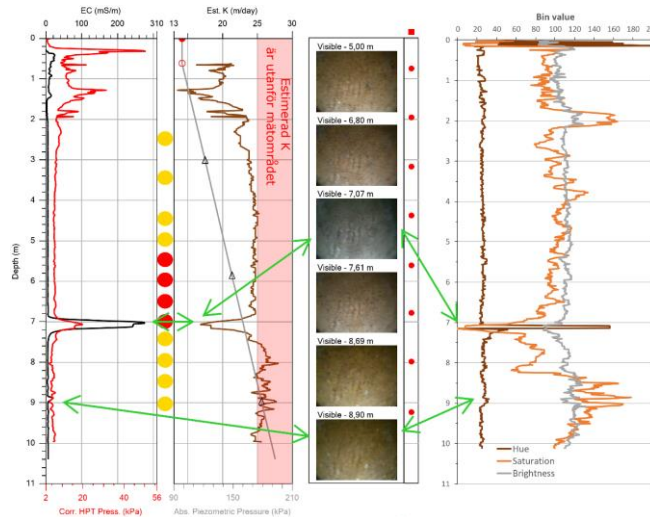
SGU

Contact person, NIRAS

Nicklas Larsson

Email

nicklas.larsson@niras.se



OIP log where slurry is only found in a zone about 7 meters below the ground surface. Black graph = EC, red graph = HPT. A selection of RGB photographs is shown, as well as the OIP camera's colour data on the right.

Pilot Test with Permeable Reactive Barrier

The dry-cleaning operations (1970-1993) at the former Hagforstvätten in Hagfors, Värmland, caused significant soil contamination. Currently, over 100 kg of perchloroethylene is annually transported in groundwater to the nearby Örbäcken stream. The Geological Survey of Sweden (SGU) commissioned NIRAS to design temporary measures to reduce this transportation.

NIRAS conducted a pilot test where zero-valent iron (ZVI) was injected as a permeable reactive barrier perpendicular to the groundwater plume, just before it reaches the stream. The injections included micro iron (Höganäs CMS), thickening agents, and in some areas, a tracer in the form of a potassium salt. The design was developed in collaboration with RedoxTech, North Carolina, US, and the injections were carried out using a NIRAS Geoprobe drill and a RedoxTech representative.

After the first round of injections, environmental monitoring showed that the desired degradation processes (β -elimination) were occurring in parts of the barrier, but the effect was insufficient. A second round of injections was performed, including a check on how the injected ZVI fluid distributed in the soil. This was done using the Geoprobe OIP-HPT, which documented the added tracer through electrical conductivity (EC), the graphite-gray colour of the ZVI fluid, and the permeability differences caused by the added iron and thickening agent.

The OIP check clearly showed that the iron did not distribute evenly in the soil profile but rather in very limited zones. The figure above shows an OIP log about 0.5 m from one of the injection points where the iron slurry was only detected in a thin zone about 7 m below the surface. Subsequent environmental monitoring also showed no significant effect from the second injection. The pilot test led to the rejection of this method as a full-scale solution.