



Project Nijmegen

Who were involved?

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Keywords

Innovative tender procedure, laboratory tests, activated Klozur® persulfate, fully automated ISCO, hydrocarbon fuels, rail soil remediation



Full scale ISCO approach at the railway pit in Nijmegen

the advantage of bench scale treatability studies as a decision making tool

Overview

A marshalling yard for trains has been contaminated as a result of leaks, spills and filling losses of hydrocarbon fuels. An in situ remediation by Biosparging, Bioventing and Nutrient dosing has been carried out in the period from 2004 to 2010. After remediation for an amount of half a million Euro, a large residual TPH contamination remained in the soil.

Innovative Tender Procedure

An additional remediation effort was contracted in an innovative tender procedure under conditions of fixed price, time, removed mass and payment. There were two selection criteria. For a fixed budget of a quarter of a million Euro, the contractor should indicate how much mass he demonstrably will remove (70% score). The plan of approach has been tested the feasibility (30% score). A number of contractors have put forward a smart solution. But there were also contractors who have decided not to make an offer.

Considerations and choice-based approach to remediation of a sub area

The main part of the pollutant load was located in the range from 14.5 to 18.5 m below ground level and comprises 47.9% of the overall load. This mass was situated in the top of

Why NTP Enviro?

- ✓ In house soil experts and chemical oxidation specialists.
- ✓ Strategic alliances with experts and third parties.
- ✓ Self designed soil remediation concepts (chemical, biological).
- ✓ Own laboratory.
- ✓ Partner of choice for many private and public clients.

the saturated zone and is more readily available to biological and chemical in-situ remediation techniques than contamination in the unsaturated zone.

Laboratory tests

By linking the results of an aliphatic aromatic TPH split group with substance group properties, a mathematical insight is obtained into possible remediation techniques. It was found that 43% of the oil is soluble in water and that more than 84% of the contamination is moderately aerobically biological or chemically degradable.

A desk study indicated that chemical oxidation would give the best results with activated sodium persulfate. On a laboratory scale, tests were carried out with alkaline activated persulfate and hydrogen peroxide activated persulfate. The hydrogen peroxide activated persulfate showed a decrease of 38-54% in the ground. However, the TPH was almost completely mobilized to the aqueous phase. Treatment with alkaline activated persulfate showed a destruction of 49-54% of TPH in the ground, with 10 times less mobilization of TPH to the water phase.

Full-Scale Application

The Full-scale remediation was carried out using a fully automated remotely controlled ISCO unit. The unit ensures complete telemetric monitoring, operating 24 / 7. Essential parameters, such as the injection pressure, the amount and flow rate of injection as well as the soil temperature were monitored continuously. During the first injection period, an amount of 6.260 kg alkaline activated Klozur® persulfate, was injected over 15 ISCO injection wells in the most polluted areas. Application of chemical oxidation with activated Klozur® persulfate leads to an increase in the pH, the redox potential and dissolved oxygen levels. Comparison of the pollutant load after completion of the chemical oxidation with the load prior to the chemical oxidation, is showing a decrease of 49% of TPH in the ground. A strong mobilization of product into the aqueous phase was not observed. A second activation of the remaining Klozur® persulfate resulted in a final decrease of 55% of the TPH levels.

Conclusions

The innovative tender procedure has led to a smart solution, according on a ISCO approach with activated Klozur® persulfate based on the results of a bench scale treatability study. It has been shown that bench scale testing is an indispensable tool in designing ISCO projects. The bench scale treatability test and full scale field results correspond to each other. After the first injection period of ISCO treatment was applied the TPH-concentration levels were successfully reduced with 49%. A second activation of the remaining Klozur® persulfate resulted in a final decrease of 55% of the TPH levels. With this result, it has been agreed by the client and the local authorities that the remediation targets have been achieved.

Roadmap for successful NTP Enviro projects

