SODECON
SUSTAINABLE SOIL REMEDIATION

NEWSLETTER
FEBRUARY
2021

IIN THIS FIRST NEWSLETTER OF THE NEW YEAR WE WANT TO FOCUS ON INJECTION TECHNOLOGIES. WE FIRST PROVIDE AN OVERVIEW OF THE VARIOUS POSSIBLE INJECTION TECHNIQUES AND THE FACTORS THAT PLAY A ROLE IN THE SELECTION OF AN INJECTION TECHNIQUE. THE CORRECT IMPLEMENTATION STRATEGY IS CRUCIAL FOR THE SUCCESS OF AN IN SITU REMEDIATION PROJECT SINCE THE SUCCESS LARGELY DEPENDS ON BRINGING THE INJECTION PRODUCT INTO CONTACT WITH THE CONTAMINATION. NEXT, WE DISCUSS AN INTERESTING COMPARATIVE STUDY WE CONDUCTED AT A SITE TO DETERMINE THE EFFECT OF DIFFERENT CARBON SOURCES AND BIOAUGMENTATION ON THE DEGRADATION OF A CHLORINATED SOLVENT CONTAMINATION. FINALLY, WE ALSO PRESENT OUR NEW LAB IN WHICH WE PERFORM TESTS TO DETERMINE THE FEASIBILITY OF INJECTION TECHNIQUES BUT IN WHICH WE CAN ALSO PERFORM OTHER TESTS SUCH AS THE EVALUATION OF THE EFFECTIVENESS OF ADSORBENTS.

WE WISH YOU A HOPEFUL 2021!

HANS AND WOUTER

SODECON

SODECON is an innovative, knowledge-driven company specialized in soil and groundwater remediation providing consultants, project developers, companies and private persons with sustainable, economic solutions to their soil issues.

A QUESTION ?
info@sodecon.be

ACHILLES RECERTIFICATION

Sodecon has successfully passed the recertification in 2020 for the safety, health and environmental care system for on-site soil remediation works according to the Achilles care system. We are certified for the next 3 years to perform standard remediation projects and complex in situ projects in Flanders.

INJECTION TECHNIQUES

Techniques such as ***in situ*** chemical oxidation and reduction, stimulation of biological degradation and ***in situ*** metal precipitation all depend on the injection of substances into the subsurface. In order to inject a substrate into the subsurface, it is important to select the best injection technique for a site. Below, we provide an overview of the possible injection techniques and the factors that play a role in the choice of an injection technique.

INJECTION TECHNOLOGIES CAN BE DIVIDED INTO 4 GROUPS:

1
DIRECT INJECTION:
with this technology, a substrate is injected into the soil while bringing an injection rod into the soil. The injection product is injected through holes at the bottom of the injection rod. There are various direct injection methods: direct push injection, Spin* injection,.. which can be used depending on the site-specific conditions. In comparison to other techniques, this method allows for injection into soils with low permeability and for injection of slurries.

2
INJECTION INTO INFILTRATION WELLS:
With this method, injection substrates are injected on a filter of an injection well. A correct well installation is crucial for an optimal yield. Sodecon strongly emphasizes the construction of a good seal of the borehole. This method is recommended when large volumes must be injected several times. This method is preferably used in homogeneous soils.

3
INJECTION ON DRAINS:
When access to a site is limited, drains can be installed through horizontal drilling to install a system in places that are difficult to reach. With drains, it is possible to inject large volumes in homogeneous soils.

4
RECIRCULATION:
This method is a combination of injection wells/drains and extraction wells/drains. The control is more complex because extraction pumps are required and measures must be taken to prevent clogging. The advantage of this method is that no external water source is needed and large plumes can be treated as recirculation can be applied continuously.

THE SELECTION OF THE RIGHT INJECTION TECHNIQUE DEPENDS ON SEVERAL FACTORS:

PERMEABILITY OF THE SOIL:
soils with low permeability require different techniques than soils with high permeability.

HETEROGENEITY OF THE SOIL:
a different strategy is needed for homogeneous soils compared to soils with a strong alternation of good and less permeable layers (heterogeneous).

GROUNDWATER VELOCITY:
The velocity of groundwater will determine when the substrates are washed out and when a new injection is needed.

DEPTH OF TREATMENT:
when treatment of deep soil layers is required, it will be more advantageous to install permanent wells instead of temporary wells.

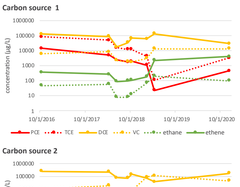
INJECTION SUBSTANCE:
soluble substances or emulsions are easier to inject. Non soluble substances are more difficult to inject and must be injected by fracturing.

Sodecon has extensive experience with all injection techniques and with different types of substrates and can design the most efficient injection strategy for a site. Sodecon can also perform injection tests to evaluate the effectiveness of an injection approach and to determine the injection parameters such as injection volumes and flows, injection pressure and radius of influence.

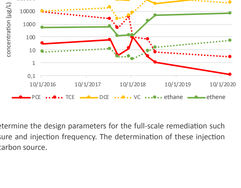
COMPARISON OF CARBON SOURCES FOR CHLORINATED SOLVENT DEGRADATION

For the remediation of a chlorinated solvent contamination, in situ tests were performed to determine the feasibility of reductive dechlorination. Carbon sources were injected into different monitoring wells and the monitoring wells were sampled at regular intervals. This method allows to determine in a relatively cheap way whether the contamination can be biologically degraded under site specific conditions. Four tests were performed on four different monitoring wells in which two different carbon sources were tested with and without bio-augmentation. From the tests it could be concluded that both carbon sources can stimulate the biodegradation in a similar way and that bioaugmentation didn't accelerate biodegradation. The graphs below show the evolution of the chlorinated solvent degradation in the 2 monitoring wells with different carbon sources without bioaugmentation. In both monitoring wells a decrease in parent compounds and production of ethene and ethane is observed. In carbon source 1, an increase in parent products is measured in the last sampling event. However, this is caused by the hydrogeological conditions, as this monitoring well is located in a different, more permeable soil layer, which means that new upgradient contamination can influence the sampling results more quickly.

Carbon source 1



Carbon source 2



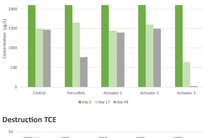
In the next phase, an injection test is recommended to determine the design parameters for the full-scale remediation such as injection flow rates, radius of influence, injection pressure and injection frequency. The determination of these injection parameters is at least as important as the selection of the carbon source.

NEW LAB

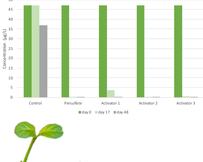
Sodecon has built a lab in its office in Deinze to perform feasibility tests to perform feasibility tests for the remediation of soil and groundwater. Some of the tests we have already performed:

- **Matrix demand tests** for chemical oxidation
- Determination of **titration curves**
- **Activator tests** for persulfate
- Tests for the **adsorption capacity** of different adsorbents
- **Degradation tests** for chemical oxidation, chemical reduction and biodegradation
- **Precipitation tests** for heavy metals

Destruction 1,1,1-TCA



Destruction TCE



So far, tests have already been executed for heavy metals, BTEX, monochlorobenzene, MTBE, cyanide, chlorinated ethenes and ethanes, 1,4 dioxane and PFAS both on soil and on groundwater. Below is an example of lab tests we recently conducted to treat a mixture of a contamination with chloroethenes and chloroethanes with chemical oxidation by persulfate. All analyses were performed in duplicate. It can be seen that chlorinated ethanes are more difficult to destroy than chlorinated ethenes, and that only activator 3 is capable of completely breaking down 1,1,1-TCA.

If you want to evaluate the feasibility of a certain contaminant in the lab, don't hesitate to contact us. We have the necessary knowledge to make sure that the lab tests match the final application in the field as good as possible.

CONTACT

DO YOU WANT TO KNOW WHAT SODECON CAN DO FOR YOU IN THE FUTURE? OR DO YOU HAVE A QUESTION ON A SPECIFIC PROJECT IN WHICH WE CAN HELP YOU WITH OUR EXPERTISE? DO NOT HESITATE TO CONTACT US.

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