In-Situ Chemical oxidation

Quick and effective remediation of contamined sites

Quick and effective in-situ soil remediation with ozone technologies

Verhoeve Milieu & Water is one of the most experienced international contractors in In situ Chemical oxidation (ISCO). Since 2003 we are working on projects based on injection of chemical oxidation substances. Increasingly we are involved in tailor made solutions, special terms and contracts.

We come up with sensible customized solutions to meet the client's requirement and suit the use of the site. In situ chemical oxidation is a need when the client wants to deal with the final remediation obligation or when pure product or DNAPL is present (source zone). In our own laboratory we can examine several oxidants to the soil type and come up with a practical advise or design.

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Technical solutions:

Verhoeve Milieu & Water is experienced in the following chemical techniques which are based on liquid and/or gas oxidants:

- Ozone sparging (added with hydrogenperoxide or permanganate;
- Perozox®)
- Fenton's reagents;
- Permanganate.

'Making contact' is important for ISCO, so a good distribution is necessary. We can achieve this with our gas-based system Perozox®. This technique is used for soil and groundwater remediation through in-situ chemical oxidation (ISCO). Chemical oxidation can be used for contaminants that are sensitive for oxidation. Chlorinated or aromatic solvents and polycyclic aromatic hydrocarbons are specially receptive to oxidation. Petroleum products are also very effectively treated with the ozone oxidation system. Therefore Perozox® is particularly useful for clean up of dry cleaner, gas stations, manufacturing gas plants and wood treatment plant sites. Using chemical oxidation, one can remediate a site quickly and effectively.

Design:

We have specially designed ozone injection points, which are creating tiny bubbles of ozone, air and capsulated ozone. Simultaneous peroxide or permanganate is injected. This combination creates a very reactive oxidizing environment. Each point is connected to the ozone unit with special small tubing. At the surface special valves and sample points can be installed.

$2O_3(g) + H_2O_2 \rightarrow 2OH^{(-)} + 3O_2$

The oxidants are made in small and well protected units. In the 'ozone' unit ozone is made out of oxygen and will be injected through a manifold with valves. In the second unit the peroxide is stocked in a reservoir. From this reservoir the peroxide is injected at the same time with the ozone injections. This process is continuing for a few months up to a few years. During the remediation controlling of the process is necessary on a frequent base. For this process we monitor the concentrations of dissolved oxygen, redox etc.

Experience and results:

We have listed about 60 projects concisting pilot tests and full scale remediation's. Most of the sites are closed and finished. The sites are mainly contaminated with chlorinated solvents with BTEX as a co-contaminant at some areas. A few projects with non common contaminants are performed: Phthalates, MCPP, PCP, MTBE, HCH.

Lessons we have learned from the oxidation systems at these projects include:

- Adsorbed fractions can be treated as well as aqueous fractions;
- DNAPL of chlorinated solvents can be treated;
- Low aqueous concentrations can be reduced to low ppb-levels;
- Quick removal and large ROI are possible;
- Smart combinations with multi phase extraction or biological aftertreatment.