Stabilisation of PFAS-contaminated soil

WHAT IS PFAS AND WHICH BENCHMARK LEVELS APPLY TO PFAS AT PRESENT?

PFAS (per- and polyfluoroalkyl substances) are a collective name for thousands of synthetic chemicals produced by humankind. These chemicals have contaminated soil and groundwater in many places around the world. PFAS released into the environment eventually ends up in food and drink. In September 2020, the European Food Safety Authority (EFSA) established a stricter assessment of how much PFAS human can ingest without posing any risk to their health. This has formed the basis for stricter requirements in Swedish environmental legislation. As such, the authorities are now proposing that the new threshold for drinking water be set at 4 nanograms per litre (ng/l) for PFAS4 (the sum of four different PFAS substances) in place of the previous threshold applicable in Sweden which was 90 ng/l of PFAS11. Denmark is one step ahead and has already tightened its thresholds in relation to PFAS4 in drinking water to 2 ng/l. The Netherlands and Belgium have also significantly tightened their respective PFAS thresholds. Other EU member states are currently working to implement stricter PFAS thresholds in relation to both soil and groundwater. The European Chemicals Agency (ECHA) has also put forward a proposal to prohibit the use of all PFAS chemicals. The substances referred to as PFAS4 are: PFOS, PFOA, PFHxS and PFNA. The use of these substances is largely regulated. The two most common PFAS substances are PFOS and PFOA. The Swedish thresholds for PFOS in soil are set at 3 ug/kg and 20 ug/kg respectively, depending on which type of activity the land in question is used for. However, it should be noted that even low levels of PFAS in soil can lead to significant groundwater or surface water contamination as the thresholds for water are very low and include concentrations of ng/l.

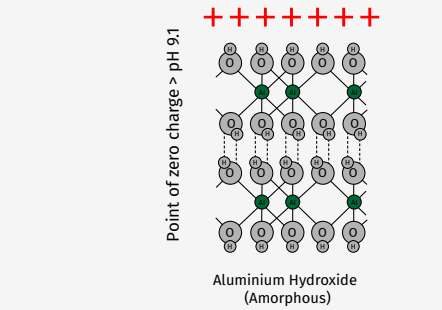
WHAT IS REMBIND?

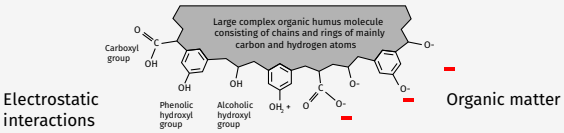
RemBind is a patented material comprising activated carbon, aluminium hydroxide (amorphous) and a number of other adsorption agents. This mixture creates a material with large surface areas with different charges which bind chemical substances through ionic bonding, Van der Waals forces (adsorption) and other physical and chemical interactions. Taken as a whole, these various binding options significantly reduce the leachability of contaminants. RemBind immobilises any organic contaminant, including PCBs, PAGs, TPH, PCP, PFOS and PFAS. It will also immobilise amphoteric metals including chromium and arsenic. RemBind has been available on the market as commercial product for about 4 years. Long-term data during this period has not shown any deterioration in efficacy. The product has undergone a number of accredited and standardised simulation tests in laboratory environments, including LEAF (EU), EN12457-1 (EU), MEP-1230 (USA) and others. These tests are the most comprehensive leaching tests that can be performed and simulate the extremely challenging conditions that can occur in nature. E.g. the Multiple Extraction Procedure (MEP) simulates 1,000 years of acid rain/precipitation on masses located in non-approved landfill sites. The results showed that masses mixed together with RemBind 100 saw their leachability reduced by >99.2% in relation to PFOS followed a period of 1,000 years.

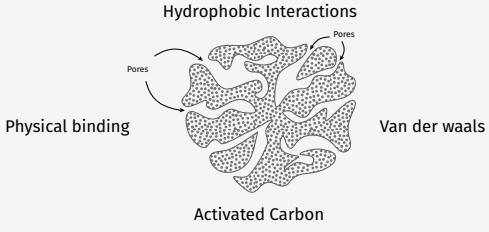
RemBind®

Rembind 100

How it works







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PRACTICAL PERFORMANCE STABILISATION – PART 1 LABORATORY-BASED STABILISATION TESTING

In the first stage, a representative sample of the contaminated soil is taken, this sample is analysed in relation to its total PFAS28 content and its total organic carbon (TOC), and the leachate is analysed following a shake test in order to verify the leachability of the soil in question. Once the results of analysis are obtained, Envytech recommends a test range with different mixing percentages (e.g. 0.5%, 1% and 2% respectively). This recommendation is drawn up based on data obtain through previous stabilisation projects. In order to verify the efficacy of RemBind 100 and optimise the mixing percentage for the product into the soil in question, a stabilisation test is first carried out at lab-scale. In this instance, Envytech uses the recommended mixing percentages. Envytech has partnered with Eurofins to ensure that all stabilisation tests with RemBind 100 are carried out in a safe and secure laboratory environment by Eurofins. This means that the customer can submit soil samples directly to Eurofins for testing following a consultation with Envytech. Eurofins performs stabilisation tests according to the method developed by RemBind Pty Ltd. Envytech then reviews all the obtained analysis results together with the customer in order to determine the optimum mixing percentage on the basis of both financial and site-specific factors. Results from previous projects pertaining to leachability and reduction can be seen in table 1.

PRACTICAL PERFORMANCE STABILISATION – PART 2 FULL-SCALE SOIL STABILISATION

The treatment process begins by roughly adding RemBind using an excavator/wheel-mounted loader. Water is added via spraying to minimise dusting and bind the treatment agent. In the next step, the masses are mixed more comprehensively by loading them into a drum sieve or sorting machine. While carrying out this mixing process, coarser fractions such as stones and gravel are removed. This sorting process can be carried out prior to the stabilisation works in order to minimise the volume and more accurately calculate the quantities of RemBind that need to be added per ton of soil. Following stabilisation, the masses can either be used as backfill on site provided that permission to do so has been obtained from the relevant environmental authorities, or the material can be removed from site for disposal in an inert landfill subject to the agreement of the receiving facility.

RemBind is currently used as a pre-treatment stage prior to the disposal of PFAS-contaminated soil at multiple reception sites in Sweden. By stabilising PFAS-contaminated masses using RemBind prior to the disposal of these masses, the risk of PFAS being found in the leachates is minimised which in turn minimises the negative impact of landfill sites on the surrounding environment.

Soil type	Pollution source	Concentration PFAS 11/ PFAS 28 (ug/kg TS)	Concentration leachate L/S2 (ng/l)	Mixture percentage Rembind 100 (%)	Concentration leachate L/S2, after stabilisation with Rembind 100 (ng/l)	Reduction of leachability
Gravel sand	Surface treatment industry	1000	230 000	3	8500	96%
Gravel sand	Surface treatment industry	1000	230 000	5	4600	98%
Gravel sand	Surface treatment industry	30	4 300	3	590	86%
Gravel sand	Airport area	231	54 000	2	23	99,9%
Gravel silty sand	Airport area	155	18 000	1	43	99,9%
Gravel sand	Airport area	48	11 000	1	1,7	99,9%
Gravel sand	Airport area	410	170 000	2	680	99,9%
Sand	Fire drill site	420	138 000	2	50	99,9%
Sand	Fire drill site	420	138 000	5	<10	99,9%
Sand	Airport area	140	160 000	1,5	4900	97%
Sand	Airport area	140	160 000	2,5	68	99,9%

Table 1: Summary of PFAS leachabilitiy for different types of soils, before and after treatment with Rembind.

Contact us!

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