Landscaping with PFAS contaminated Soil and thin permeable Barriers

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The removal of per- and polyfluoroalkyl substances (PFAS) from our environment is becoming one of the major environmental challenges facing landowners, environmental protection agencies and construction consultancies worldwide. Large quantities of soils need to be remediated so that impact pathways of these chemicals are interrupted. Since many of the contaminants are readily soluble in water, widespread dispersal occurs in groundwater. Different soil remedial options are developed during the last years. Soil washing, for example, can be used for PFAS removal from soils. This process requires large purification plants, but offers a good possibility to remove PFAS. However, for process reasons, the technique can only be used if the percentage of fines in the soil is not too high. In addition, the amount of contaminated soil must be large enough to make the assembly of the facility worthwhile. Landfilling of soil is possible (in Germany) if the landfill has a leachate treatment. Uncertainties regarding legal regulations and a decreasing landfill volume lead to high disposal costs.

In many cases, the polluted soil is well suited as building materials in landscaping structures and noise barriers due to their mechanical properties. However, to allow the use of PFAS-contaminated soils in these earthworks, the risk of percolation of the contaminants must be eliminated. Encapsulating with the help of a thin permeable barrier allows unimpeded water flow through the structure, but prevents PFAS-pollutant discharge. In percolation tests according to DIN 19528 on the elution behaviour of the pollutants, the use of thin permeable barriers against various PFAS compounds was investigated. In laboratory tests, a soil with a heavy PFOS and PFOA load was percolated. The readily water-soluble contaminants were washed out and passed a 6 mm geocomposite filter. No detectable PFAS were measured in the eluate. Analysis of the soil showed that no PFAS were present here either. As a result, all PFAS were found to be bound in the thin permeable barrier. Due to the fast reaction kinetics of the sorbent, the very thin design of the filter is possible.

The success from the laboratory tests is to be repeated in a pilot project in the field. A test field will be constructed on the site of an airport to demonstrate safe reuse of contaminated soil. The thin permeable barrier will be placed under the PFAS contaminated soil. Since the sorbent is mechanically consolidated between two geotextiles, a constant layer thickness of approx. 6 mm is ensured. In the pilot test, the backfilled earth structure is artificially irrigated to replicate the rainfall events of a 25-year service life. The water passing through the structure and the barrier is collected and analysed at regular intervals. In addition to the quantitative performance of the filter's PFAS removal, the following research is investigated:

- What influence do weather conditions have on the performance of the sorbent?
- How constant is the long-term effectiveness of the sorbent, also taking into account competing anions?
- Does a biofilm form on the surface of the sorbent and what effect does this have on the performance of the barrier?

When the project is successfully completed, it will be possible to reuse highly concentrated PFAS-contaminated soil in earth structures or to store it safely in the long term.