

Comparison of Different Approaches for Removal of PFAS in Water

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Background/Objectives. In August 2007, there was a large fire on a site where shredders had been in operation as part of a recycling process. Shredding of wood and metal had been the main business of that company. During the process of unloading metal waste from a railway carriage a fire had started on the metal pile which covered an area of about 30000 m². Due to the structure of that pile it was very difficult to get that fire under control. It took more than four days and it had involved about 700 members of action forces to get that fire blown out. As water wasn't successful at the early stage it was decided that the fire-fighting brigades use about 120 m³ of fire-fighting foam.

Years later, PFC (or PFAS) had been detectable in the drinking water wells some kilometres downgradient of that site. Further investigations have shown that the use of fire-fighting foams had caused the contamination in the groundwater on site and downgradient.

Approach/Activities. An extended field test was performed on site from July until December 2016. The background of this approach was to collect data to answer two main questions referring to the treatment of PFC-contaminated water. Is it technically and economically more efficient to run a pre-treatment step before contaminated water enters the carbon vessels. Furthermore, it was of interest to identify which type of carbon shows better performance and which carbon is more economical.

During the field test, contaminated groundwater was pumped through a treatment plant at a flow rate of about 540 L/hr. Starting at the groundwater well the water got split into two lines called 1 and 2 (ratio 50:50). At line 1 the water went through a sand filter and then it was split into three lines. Water passed three vessels that were filled with carbon A, B, and C. At line 2 the water went through a pre-treatment unit first for generating flocs that contain some PFC. Afterwards it went through a sand filter and then again it was split into three lines. Water passed the three vessels that were filled with carbon A, B, and C. Samples were taken at the well, behind the filtration and behind the carbon units. The same three carbon qualities A, B, and C got used in both lines.

Results/Lessons Learned. Twenty parameters of PFC were measured in the lab. At the beginning of that test period the concentration of PFC had been at about 7 ppb. At the end of that test period about 2.4 ppb got measured. The main PFCs were PFOS (start 60% and end 80%) and H4PFOS (10.5 and 5.3%).

No change was detectable in the PFC concentration after the sand filter in line 1. In line 2 the pre-treatment, by generating flocs that contain a certain part of the PFC, between 65 and 75% of the PFC got removed by this filtration process. At higher concentrations, the removal rate had been higher at that step.

The order of performance of the three carbon qualities A, B, and C were the same in both test scenarios. The differences had been less in the scenario with pre-treatment. Furthermore, the carbon lifetime was much longer in that scenario which kept the effluent concentrations at a much lower level.