

Cleaning of PFAS-contaminated fire-fighting water, fire-fighting trucks and stationary fire-fighting systems with the PerfluorAd®-Technology

The Source

Fire extinguishing foams may contain per- and polyfluorinated alkyl substances (PFAS) which are widely known to be globally dispersed in air, water and soil due to their high persistence. In addition, some PFAS substances are known to have both carcinogenic and mutagenic effects on humans.

The Problem

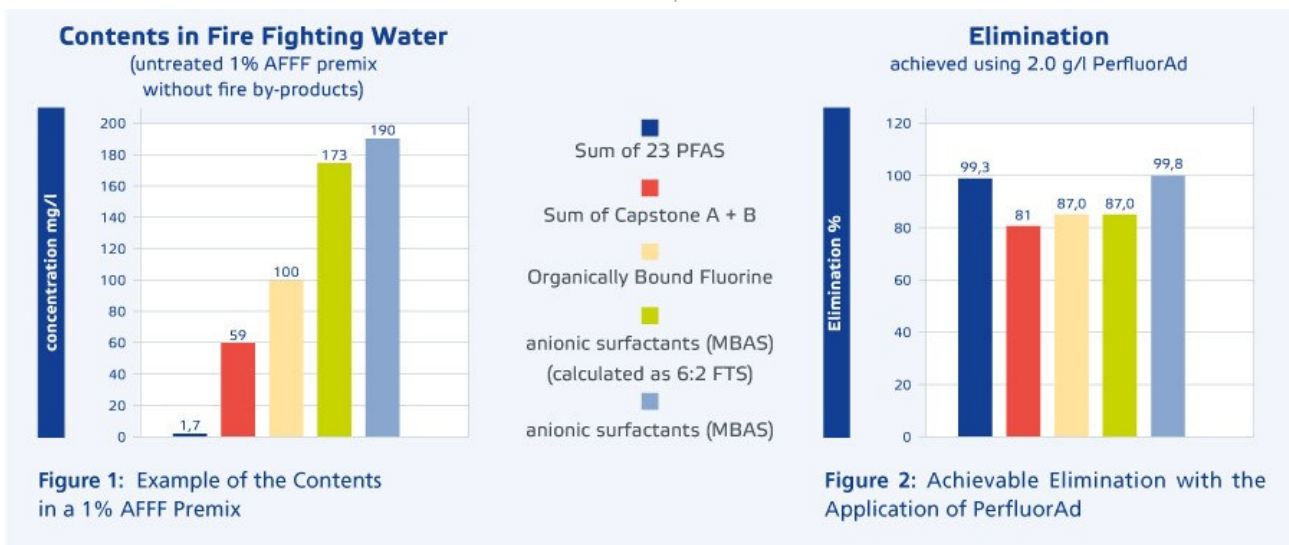
Conventional processes based on adsorption of PFAS on activated carbons or ion exchange resins are neither efficient nor cost-effective for high PFAS concentrations and complex water conditions, as is the case with AFFF-influenced waters. In addition to PFAS, firefighting waters contain many other organic constituents in high concentrations. These organic substances compete with the PFAS compounds, which are already very difficult to adsorb, in adsorption on activated carbon and ion exchange resins.

Since most organic substances are much more easily bound on activated carbon and ion exchange resins than PFAS, it is thus hardly possible to retain PFAS.

The Solution

Cornelsen Umwelttechnologie GmbH, Essen/Germany, together with the Fraunhofer-Gesellschaft - the world's leading organisation for application-oriented research - has developed PerfluorAd® technology, a highly efficient process approach for treating PFAS-contaminated water and surfaces. PerfluorAd® is a specialised precipitant which binds with dissolved PFAS compounds. In contrast to activated carbon or resin therefore, rather than adsorption, PerfluorAd® is a precipitation technology. It is an effective technology for removing PFAS compounds from surfaces as well as treating PFAS contaminated waters.

Figure 1 shows that in addition to the PFAS compounds which can currently be analysed, and therefore detected, significantly higher concentrations of other organic compounds can also be present in fire-fighting waters. Figure 2 shows that PerfluorAd successfully removes a major part of those "hidden" PFAS compounds in addition to those PFAS compounds which can be analysed.



PFAS contaminated fire-fighting vehicles and stationary extinguishing systems

Before switching to fluorine-free extinguishing agents from those which contain fluorine, it is essential to clean all the fire-fighting equipment in order to prevent re-contamination from residual PFAS and other fluorine Compounds adhered to the internal surfaces.

PerfluorAd® technology is highly effective at decontaminating fire-fighting trucks and stationary extinguishing systems as well as treating the recovered rinsate fluids.

Cornelsen is the first company to have undertaken this service and has gained considerable experience doing so.

The PerfluorAd treatment process is delivered in 3 stages:

Step 1:

Drain down and empty the fire-fighting truck or stationary extinguishing system of all foam agents containing fluorine

It is essential to identify and drain all residual dead spots in inaccessible areas of the system.

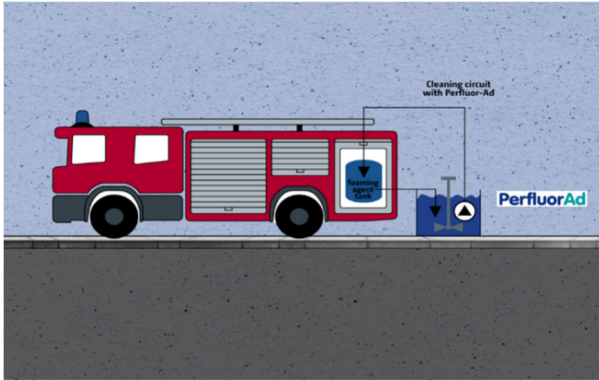


Figure 3a: Performance of the PerfluorAd flushing process on firefighting vehicles

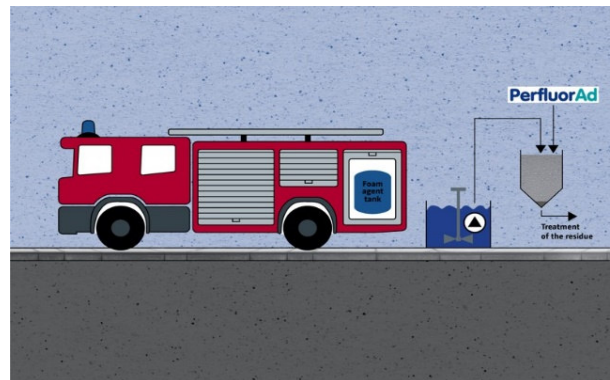


Figure 3b: Treatment of the produced rinse water in a separate PerfluorAd step directly on site

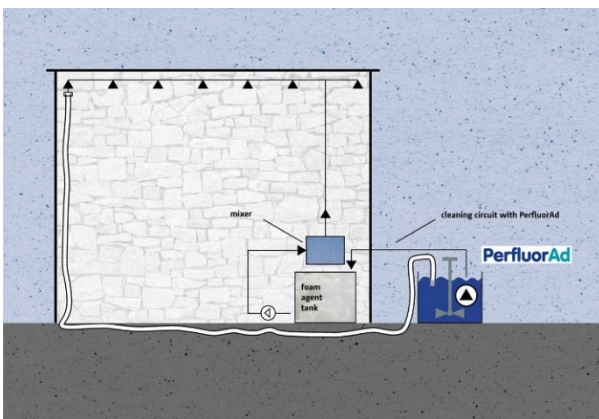


Figure 4a: Implementation of the PerfluorAd rinsing process for stationary extinguishing systems

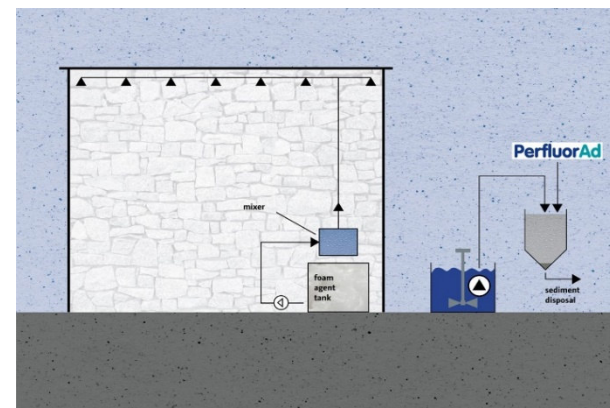


Figure 4b: Treatment of the produced rinse water in a separate PerfluorAd step directly on site

Step 2: Rinsing process with PerfluorAd® enriched rinsing water

The rinsing process must include the more inaccessible components of the system including pipelines, fittings, mixers, sensors etc. The tank(s) is typically not the greatest challenge.

Step 3: Treatment of the rinse water after completion

Following treatment of the fire extinguishing system, the recovered rinse water is now also treated using the PerfluorAd® precipitation process leading to the generation of PFAS (and associated hidden fluorine compounds) flocs which are removed by filtration. Therefore, only this very small quantity of PFAS waste is sent off-site for high temperature incineration. The treated rinse water can therefore be re-used or discharged.

Cornelsen is officially authorised to undertake the cleaning of fire-fighting trucks both at our own premises in Essen, Germany and also at our client's premises.

Mobile Treatment plant

Cornelsen is equipped with mobile water treatment plants which can be delivered to site and, thanks to a plug-and-play approach, can be commissioned and treating highly contaminated water rapidly at the point of source.



Figure 5: Mobile PerfluorAd treatment plant for the treatment of rinse water or extinguishing water