**Drinking water contamination with perfluoroalkyl acids – Source tracking, distribution modeling and influence on concentrations in human serum**

Urs Berger1,2, Irina Gyllenhammar3, Maria Sundström1, Philip McCleaf4, Karin Eurén4, Sara Eriksson4, Sven Ahlgren4, Sanna Lignell3, Marie Aune3, Natalia Kotova3, Anders Glynn3

1 Department of Environmental Science and Analytical Chemistry (ACES), Stockholm University, Stockholm, Sweden

2 Department Analytical Chemistry, Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany

3 National Food Agency, Uppsala, Sweden

4 Uppsala Vatten och Avfall, Uppsala, Sweden

In 2012 a contamination of drinking water with perfluoroalkyl acids (PFAAs) was uncovered in the city of Uppsala, Sweden. The aim of the present study was to determine how these substances have been distributed from the contamination source through the groundwater to the drinking water and how the drinking water exposure has influenced the levels of PFAAs in humans over time.

The results show that PFAA levels in groundwater measured 2012–2014 decreased downstream from the point source, although high ΣPFAA levels (4100 ng/L) were still found several kilometers from the point source in the Uppsala aquifer. Usage of aqueous film forming fire-fighting foams (AFFF) at a military airport in the north of the city was identified as the most probable contamination source. Computer simulation of the distribution of PFAA-contaminated drinking water throughout the city using a hydraulic model of the pipeline network suggested that consumers in the western and southern parts of Uppsala have received most of the contaminated drinking water.

PFAA levels in blood serum from 297 young women from Uppsala County,sampled during 1996–1999 and 2008–2011 were also analyzed. Significantly higher concentrations of perfluorobutane sulfonic acid (PFBS) and perfluorohexane sulfonic acid (PFHxS) were found among women who lived in districts modeled to have received contaminated drinking water compared to unaffected districts both in 1996–1999 and 2008–2011, indicating that the contamination was already present in the late 1990s. Isomer-specific analysis of PFHxS in serum showed that women in districts with contaminated drinking water also had an increased percentage of branched isomers. Our results further indicate that exposure via contaminated drinking water was the driving factor behind the earlier reported increasing temporal trends of PFBS and PFHxS in blood serum from young women in Uppsala.