EGU24-2002, updated on 19 May 2024
https://doi.org/10.5194/egusphere-egu24-2002
EGU General Assembly 2024

Tracing sources of diffuse PFAS pollution: PFAS contamination in soil near a Municipal Waste-to-Energy plant

Joris Dijkstra, Noemi Brunschwiler, and Jasper Griffioen
TNO, Geomodelling, Utrecht, Netherlands (joris.dijkstra@tno.nl)

Poly- and perfluoroalkyl substances (PFAS), among which are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), are common contaminants in Dutch soils, originating from fluorpolymer- factories (for PFOA), firefighting training grounds (for PFOS), or other often unknown sources. Previous research suggests that Municipal Waste-to-Energy (WtE) plants may be a source for diffuse PFAS contamination in the Netherlands, where 13 WtE plants are currently operational. Even though PFAS compounds should be eliminated at the temperatures at which WtE plants operate, the existence of “cold spots” in the oven is known and may imply that PFAS survive the combustion process. To investigate the potential contribution of WtE plants to diffuse PFAS contamination, a case study was set up in which topsoils surrounding a WtE plant in Alkmaar (Netherlands) were investigated. Ten locations were selected of which the soil profiles were undisturbed at least for 50 years and for which no other known PFAS sources are nearby. Eight locations were in the predominant wind direction (from SW to NE) and within a 5 km radius from the WtE plant. Two reference locations were located upwind. Each location was drilled to a depth of 80 cm and sampled with 10 cm intervals. Samples were analysed for 10 different PFAS and various bulk chemical and physical soil properties. In addition, PFAS was analysed in ashes from several modern WtE plants.

PFAS content is generally above national threshold values in the top layer of the soil (<30 cm) downwind of the WtE plant. In addition, considerable PFAS contents were detected in the ashes from WtE plants, indicating that PFAS are able to survive the combustion. The PFAS soil profiles follow a bell-shaped pattern with the highest content observed at 10-20 cm depth rather than directly at the surface. This indicates that most of the PFAS contamination originates from past emissions which have now decreased. A weak correlation between the distance from the waste incinerator and the measured PFAS content in the soil profile is found. Hydrus-1D, a reactive transport model code, was used to calculate content-depth profiles of PFOA and PFOS under three different emission/deposition scenarios to assess whether the emissions could account for the observed contamination depth patterns. The model calculations support the hypothesis that the observed PFAS content-depth profile can be explained by historical emissions and that the main source of contamination has decreased. This observation is consistent with the termination of a previous waste incineration plant, located on nearly the same spot, in 1996. The old incineration plant is likely to have had a less efficient combustion process. Based on the results of this study, a contribution of waste incineration to diffuse PFAS contamination is likely; additional research is

needed to investigate the influence of other possible sources.