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Perfluorinated Compounds (PFCs) in Landfill leachate

BACKGROUND

PFCs are of increasing interest in Australia and have been detected at a number of locations nationally and internationally especially where fire fighting facilities were located.

PFC testing is now well established in Australia (NATA accredited methods from June 2009) and detection limits are extremely low. With increasing interest in these chemicals the question has often been asked – where do they end up and where do you find them? Many studies have been carried out internationally and the presence of Bisphenol-A and DEET have long been identified as common in leachates among many landfills. In more recent time, PFCs have been detected in landfill leachates. This is of interest due to their inclusion in the Stockholm Convention and also their physical properties and mobility.

PRIMARY HISTORICAL USES OF PFOS

In Europe PFOS has been used in the following industries and it is reasonable to assume the same in Australia. As can be seen, these industries produce many products which can end up in landfills:

- Textile impregnation and surface protection
- Impregnation of packaging (paper/cardboard)
- Cleaning agents, waxes/polishes for cars/floors
- Surface coating, paint and varnish
- Oil production, mining and photographic industries
- Electrical, electronic and semiconductor industries
- Aviation hydraulic fluids
- Pesticides
- Medical devices
- Metal plating
- Fire-fighting foams

PFOS and other PFCs have also been found in cookware, water repellents, fibre protectors and carpets among many other common industry products in Europe.

LINKS TO RELEVANT ENVIROMAIL™

EnviroMail67 - Aqueous Film Forming Foams AFFFs - March 2013
EnviroMail38 - PFOS & PFOA in Water & Soil - June 2009.pdf

TRIAL STUDY

With a number of overseas papers reporting the presence of PFCs in landfill leachates and the question often raised as to 'what makes up the organics or TOC in my landfill leachates,' ALS commenced a small study in Australia. This involved determining whether PFCs were present in a random selection of landfill leachate, aeration pond and evaporation pond samples. Fifteen leachate type samples were tested from small and large metropolitan landfills across three states. A very small survey of groundwater samples was also performed.

PFCs in landfill leachates plus aeration/evaporation ponds

- PFCs were detected in all landfill leachates/evaporation/ aeration pond samples with PFOS or PFOA found in every sample tested.
- PFOS was detected at up to 1.87ug/L with two results over 1ug/L in leachates/evaporation/ aeration pond samples.
- PFOA was detected at up to 0.88ug/L with six samples returning results over 0.5ug/L
- 6:2 FTS and 8:2 FTS were detected in 10 of 15 samples tested and at levels up to 13.0ug/L with several results over 10ug/L
- Other PFCs were detected at up to 4.6ug/L with PFBS, PFHxS, PFHxA, PFHpA, PFOSA and PFNA the most prevalent.

This data demonstrated that PFCs are present in landfill leachates in Australia as identified overseas and that appropriate controls may be warranted. Please see figure 1 overleaf for the profile of leaches detected and figure 2 with analytical LORs, median results of positive detects and CAS numbers.

PFCs in landfill groundwaters

A very small set of ground water samples were analysed for PFCs. Trace detections were observed for PFOS, PFHxA or PFNA in three of five samples tested with detects at levels of 0.02 to 0.03µg/L below current levels of concern which are often based upon US guidelines e.g. Minnesota Dept. of health guidelines for protection of Groundwater..

FIGURE 1: DISTRIBUTION OF PFCS IN LANDFILL LEACHATE, AERATION AND EVAPORATION PONDS.

The following data summarises the distribution of PFCs in a small set of fifteen leachate samples.

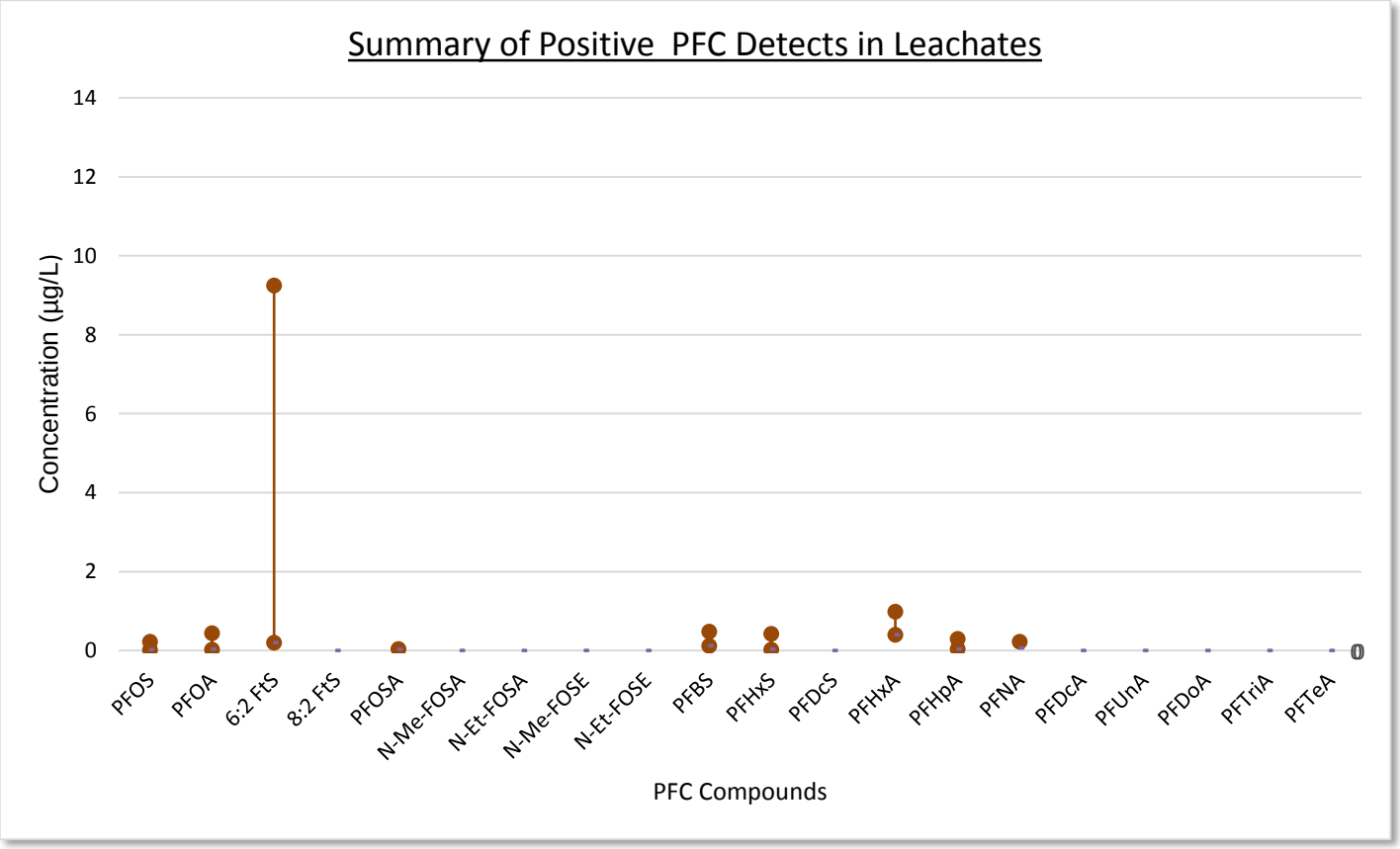

FIGURE 2: PFC MEDIAN RESULTS, LORS AND CAS NUMBERS.

The adjacent data summarises median results of positive detects in leachate type samples, along with CAS numbers and the LORs of the NATA accredited method used for analysis.

EP231: Perfluorinated Compounds	CAS number	median result (µg/L)	LOR (µg/L)
PFOS	1763-23-1	0.23	0.02
PFOA	335-67-1	0.44	0.02
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	9.25	0.1
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	N/A - not detected	0.1
PFOSA	754-91-6	0.04	0.02
N-Me-FOSA	31506-32-8	N/A - not detected	0.5
N-Et-FOSA	4151-50-2	N/A - not detected	0.05
N-Me-FOSE	200405	N/A - not detected	0.5
N-Et-FOSE	1691-99-2	N/A - not detected	0.5
PFBS	375-73-5	0.48	0.02
PFHxS	3871-99-6	0.43	0.02
PFDcS	67906-42-7	N/A - not detected	0.02
PFHxA	307-24-4	0.99	0.02
PFHpA	375-85-9	0.3	0.02
PFNA	375-95-1	0.23	0.02
PFDcA	335-76-2	N/A - not detected	0.02
PFUnA	2058-94-8	N/A - not detected	0.05
PFDoA	307-55-1	N/A - not detected	0.05
PFTriA	72629-94-8	N/A - not detected	0.05
PFTeA	376-06-7	N/A - not detected	0.5